AMERICAN MACHINIST

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Improved Machine Tools.

We represent on this page a radial drilling machine and a twist drill grinding machine, and on page 2 a small engine lathe, from the machine tool works of William Sellers & Co., Philadelphia, Pa.

In the drilling machine the arrangement is such that the drill can be expeditiously brought to the work to be drilled, the latter being situated upon the base of the machine or upon the top or side of the slotted table. To accomplish this the swinging arm is hinged to the saddle, and the latter is fitted to slide freely up and down on the face of the column, being moved in either direction by power. The distance apart of the journals upon which the arm swings provides for rigidity in that respect, while the length of the saddle is such that, being accurately fitted to the column, it is not necessary to clamp it in its varied positions.

The drill spindle, of cast steel, is counterbalanced, and carried close to the face of the swinging arm. It is moved toward or away from the column by means of a spiral pinion and rack.

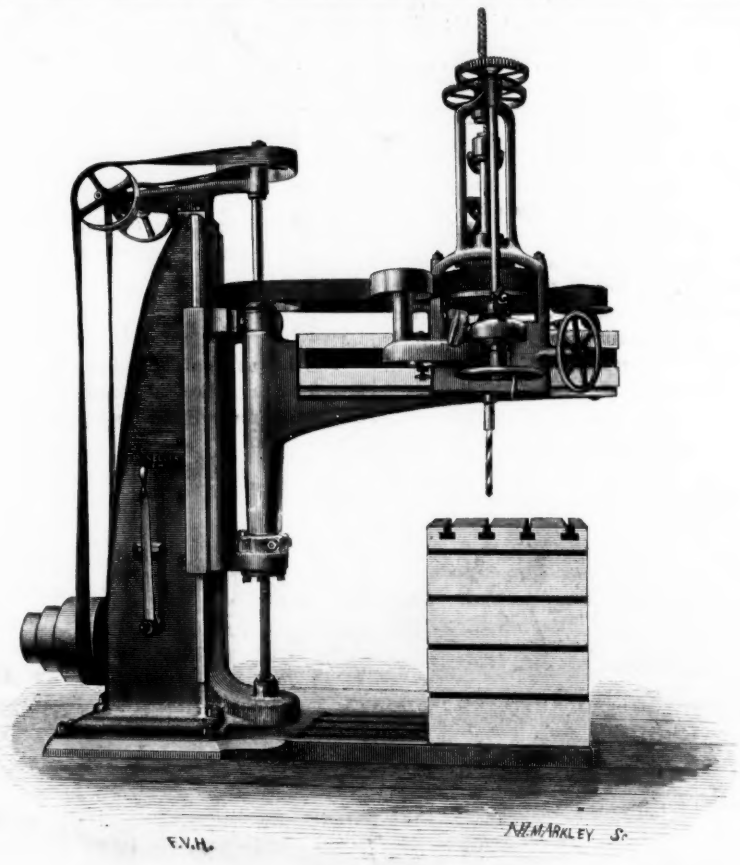
The cone pulley is convenient for shifting the belt for different speeds, and from it the belt is led over guide pulleys, so as to drive the spindle without the intervention of gearing. The "Sellers" feed discs are used, giving the usual variety of feed. The adjustments of feed, throwing in and out, back gears, etc., are as quickly made as in a lathe.

The drill grinding machine is provided with a peculiar two-jawed chuck, operated by the hand wheel *A*. The drill to be ground is held near the lip by these jaws, a notch in the latter, against which the edge of the groove abuts, providing for holding it in the correct position. At the shank end the drill is held by means of the center *B*, attached to a sliding sleeve. The emery wheel is journaled in the frame *C*, the lower part of which forms a water tank. A casing entirely covers the emery wheel, except for a small space on the side, against which the drill comes in grinding. This frame is rocked forward towards the drill to be ground by means of the handle *D*, and is returned by means of a lever and counterweight. From the water tank water is constantly supplied to the wheel by means of a small endless belt.

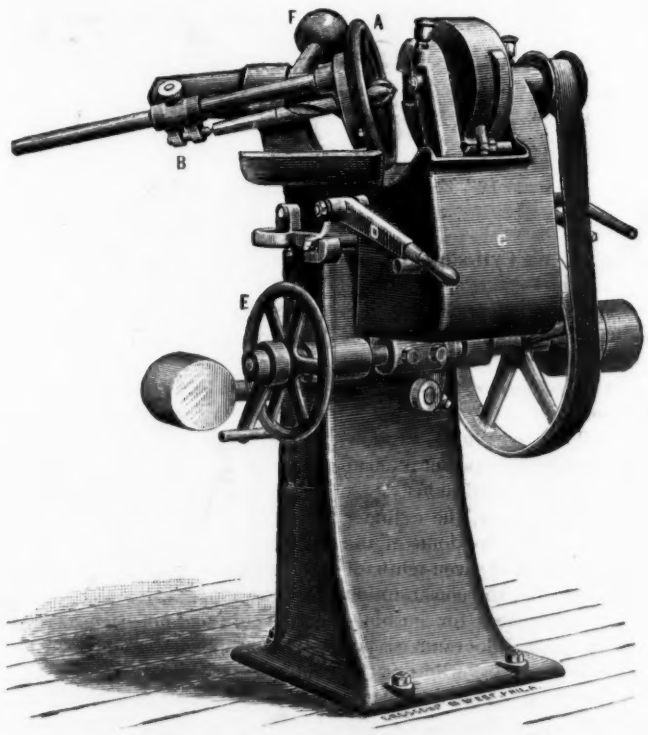
The drill being in position, the emery wheel is carried forward by the handle, and adjusted to cutting contact by means of the hand wheel *E*. For backing off, or giving clearance, the lever *F* is brought forward against a stop, and being released returns to its normal position.

The engine lathe is a 12″ swing, embracing some recent improvements over those formerly built by this firm. One of these is the bringing the operating mechanism into a position more convenient for the operator, and another an improvement in the device for locking the dead spindle. Formerly this spindle was clamped at the front end only by the use of a concentric split taper collar or bushing, which being drawn into a correspondingly tapered section of the hole through the headstock, closed the collar rigidly over the spindle. While this locked the front end centrally, when the back end and the hole became worn, it still left the spindle free to move to an extent equal to the amount of the looseness at the back end.

In the present arrangement the spindle is clamped by sleeves at both the front and back end of its bearing, thus correctly centering it, and holding it quite rigid and in line. This arrangement also makes it possible to provide for the spindles of all being made interchangeable. The spindle is locked and unlocked by the simple motion of the handle shown.



RADIAL DRILLING MACHINE.



IMPROVED TWIST DRILL GRINDER

The Cleveland, Akron and Columbus Railroad counts its time from 1 to 24 o'clock.

An association has been formed to introduce, foster and develop the American tin plate industry, and to endeavor to have such laws enacted as will afford adequate protection to the business. Wm. J. Lewis, of Pittsburgh, is president, and W. E. Cronemeyer of the same city, secretary.

Cost of Machine Shop Products.

BY A GRADUATE OF SACKETT'S SHOP.

How many machine shop proprietors are there that know just how much their product costs them? No doubt they all know how much they pay for labor and material on certain jobs, and on machines that they make a specialty of building, but there are very few of them that know what the shop expenses are; or to put it more plainly, how much it costs them to run their shop after they have paid for labor and material, and I don't believe there are very many of them that know what items to charge to shop expenses.

I am not speaking of the large manufacturing establishments with their excellent systems of book-keeping and time-keeping, because these are very few as compared with the hosts of small shops throughout the land.

It is of the small shops I speak, many of the proprietors of which are young men just starting independently, and having worked hard in the shop have had no chance to gain business experience.

Let us now consider what properly belongs to shop expenses. First there is interest on the capital invested. Next comes the deduction to be made for wear and tear of machinery and tools. This latter is one of the most important things to be considered by shop managers in computing their running expense accounts. After this come the following, viz.:

Wages of engineer, laborers, clerks and all non-producers, including the proprietor himself if he does not work in the shop; coal burned; oil and waste used; insurance; freight and cartage; rent; advertising and traveling.

By keeping separate accounts of the above items the shop owner will be enabled to tell at the end of the year (by adding them together) what it costs him to run the shop. This can be divided by twelve to show the running expenses for the month, or by fifty-two to show them for a week.

In regard to the depreciation of value of machinery and tools from wear and tear and by becoming out of date, I will say that from my own experience and from what I have learned from other successful men, that the minimum amount charged for wear and tear should be taken at 10 per cent. on the value of the plant.

Many argue that this is an excessive amount to charge against the shop earnings for the year, and that if they followed that plan they would make no money. I simply assert that if shop owners do not do something of the kind they will find themselves some of these fine days with a lot of old worn out machinery and tools on their hands and no money to replace them again. If proper deductions are not made for wear and tear, where is the allowance to be made for the thousands of taps, drills, reamers and other small tools that are daily broken by legitimate use or by carelessness, and where is the money coming from to buy the new ones to take their places?

Shop owners should bear in mind that in deducting 10 per cent. annually from the value of their plant, they do not spend any

more money than if they deducted nothing from it.

One great advantage, particularly to new beginners, is that by taking off a good slice for wear and tear, they do not deceive themselves by thinking they are making more money than they actually are making, and if they are deceived in the other way there is nobody hurt.

Suppose an owner reduces the value of his machinery and tools to nothing on his books. At the end of from ten to fifteen years, and by actual appraisement they are worth say one-third of their original cost. Then in that time he has made whatever profit his books show, plus one-third the value of his plant. Suppose, however, instead of deducting a good slice for wear and tear, he only deducts a nominal sum, say 1 or 2 per cent. (as many do) and keeps on charging up big profits. At the end of ten or fifteen years his plant is inventoried at a trifling amount below its first cost, and actual appraisement shows his machines to be valued as in the previous case. This man would be sadly disappointed were he to sell out an appraised value of plant and close his business. Where would be all the large profits he had been charging up during these ten or fifteen years? Don't you think Mr. Editor, that when he struck the final balance sheet of that business that he would look at the difference between his actual profits and profits shown by his mode of figuring, and wonder if there was not a mistake somewhere?

Of course there is a happy medium between these two cases, but it is far better to err on the safe side than on the unsafe.

Now that we have considered what constitutes shop expenses, the next thing in order is to know how to keep a record of them and apply them to the cost sheets to easily and readily show the actual cost of work done.

I know of a little shop in the back-woods of Pennsylvania where they do some pretty good work, and where the proprietor is superintendent, draftsman, book-keeper, correspondent and traveling agent all in one. He has found it necessary to devise certain systems of keeping accounts to avoid the necessity of clerical help. I was down at that shop the other day, and in accordance with a promise procured for you a sample of one of the cost sheets devised by said proprietor.

I inclose it with this letter, and if you see fit to illustrate it you can use the following description of it:

In the first column is placed the date of the ending of the shop week. In the second is the total number of hours worked by all hands (excepting engineer and laborers) during the week. In the third column are put the shop expenses for one week. The shop expenses for one week divided by the total number of hours worked, gives the average rate of expenses per hour per man employed. This is put in the fourth column. In the fifth column is put the number of hours worked on "this job" during the week, and in the sixth column is put the amount of wages paid for the week's work on this job. The average rate of expenses per hour per man employed multiplied by the number of hours worked on this job during the week, and the product added to the wages paid for the week's work on this job gives us the total cost of the week's work on this job. This is put in the seventh or last column. Below, the sheet is ruled for the totals and averages of all the columns, which will in the course of time show the percentage of full time made by the men, the average expenses per hour, the average of wages paid to each hour worked, and the average value of work turned out per dollar paid in wages.

Below the average space is a blank left for cost of material used in construction, which added to the total cost of machine work, gives the total cost of the job. If a shop owner has a certain charge per hour for work he can soon tell whether that amount is paying him or not.

A book made on the plan of this sheet will, if properly kept up, be of incalculable value as a means of getting the nearest parallel case when called upon to estimate for a job.

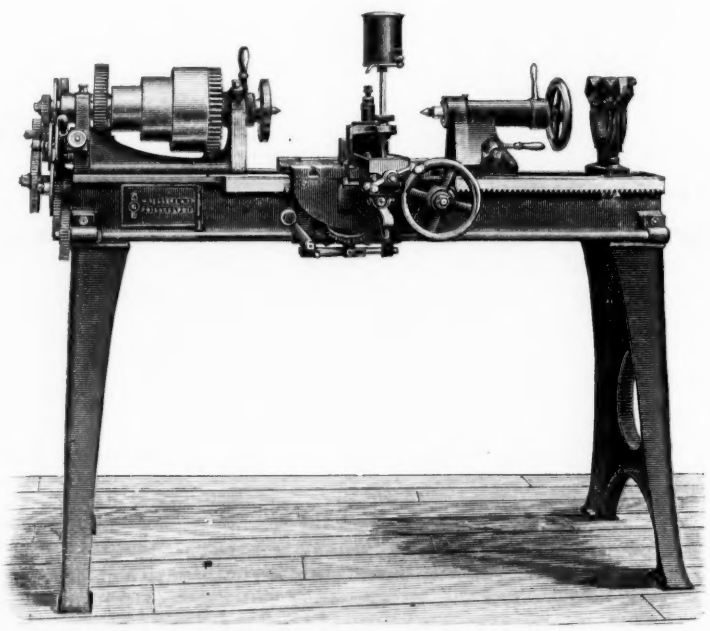
Perhaps I have been too prosy and spun my yarn too long, but if this will only set some young shop owners to thinking about what their work really costs, and stop their Wyckoff style of guessing at it, my aim will be accomplished.

COST OF _____

Date.	Number of hours worked during the week.	Shop expenses for the week.	Average rate of expenses per hour.	Number of hours worked on this job during the week.	Amount of wages for the week's work on this job.	Cost of the week's work on this job.
1882.						
July 27 ..	637	130 00	20.5	78	14 21	30 20
Aug. 3 ..	675	130 00	19.3	208	45 68	85 82
" 10 ..	639	130 00	20.4	271	56 30	111 58
" 17 ..	655	130 00	19.9	157	37 28	68 52
" 24 ..	640	130 00	20.3	130	26 23	52 62
" 31 ..	691	130 00	18.8	120	18 37	40 93
Sept. 7 ..	700	130 00	18.6	5	37	1 30
" 14 ..	677	130 00	19.2	9	1 53	3 26
" 21 ..	669	130 00	19.4	10	90	2 84
Total...	5,983	1,170 00	176.4	988	200 87	397 07
Average ..	665	130 00	19.6	110	22 32	44 12

Cost of materials used—

240 lbs. m'ch'y steel, @ 5½	$13 20	
8,964 lbs. castings, @ 3½, $^{313\ 74}$; 48 set-screws, @ 7. $^{3\ 86}$	317 10	
		$330 30
Cost of machine work		397 07
Total cost		$727 37



12" ENGINE LATHE.—See page 1.

Jacketing Steam Cylinders.

A German engineer, Herr Heim, has gathered some interesting figures bearing on cylinder condensation which he communicated recently at a meeting of the German Society of Engineers.

He quotes the following example to show the effect of jacketing on the consumption of steam in engines running continuously: A 6-horse power portable engine, the cylinder of which was placed within the dome of the boiler, was run, cutting off at seven-tenths of the stroke. Theoretically, the consumption of steam, making allowances for cushion, should have been 114.2 kilogrammes per hour. In reality it was, according to the weighed quantity of feed-water used, 159 kilogrammes, or an excess of 35 per cent.

With a non-condensing Wheelock engine, having a diameter of 18" and cutting off at seventeen one-hundredths of the stroke, the excess was 35 per cent. For condensing engines the loss due to the greater consumption of steam is higher.

As an average with engines running with five atmospheres boiler pressure, 20" diameter of cylinder and from 7 to 9 feet piston speed per second, he gives the following figures for the excess in the actual consumption of steam over the theoretical quantity:

	CUTTING OFF AT One-tenth. per cent.	One-fifth. per cent.	One-third. per cent.
Without jacket.	72	62	55
With jacket.	64	54	48

The influence of the piston speed is illustrated by the following example: A blowing engine with a cylinder, not jacketed, 32 in. in diameter, 62 in. stroke, and a piston speed of 3 ft. per second, showed an excess of 96 per cent., while experience with similar engines running with 7 ft. piston speed exhibited an excess of only 70 per cent. Condensing engines waste more steam. An engine without a jacket, having a 20 in. cylinder, and running with five atmospheres boiler pressure, was provided with condensation, and yielded 1.4 times as much power as before. At the same time, however, the excess of steam consumed over the theoretical quantity, which remained the same, had increased from 42 per cent. to 62 per cent., so that the actual gain had not been so great as the increase in power would lead to believe, but only 23 per cent.

These examples show the effect of steam jacketing on engines running continuously. With those running at intervals the loss is heavier. A two-cylinder condensing hoisting engine, with 24 in. cylinders and 41 in. stroke, was cutting off, by means of the eccentrics, at seven-tenths of the stroke, and by means of a gear at three-tenths. Although the weight of the rope was perfectly balanced, much more power had to be used, cutting off at seven-tenths or under, to move the dead weight during the first two or three revolutions. Then steam was cut off at three-tenths, and from the third to the last revolution the steam was gradually throttled. Fourteen diagrams were obtained during one run, showing that the average effective steam pressure declined from 3 to 0.7 kilogrammes per square centimeter. The engine was started and stopped 26 times an hour, bringing up 1,450 kilogrammes from a depth of 164.3 meters every time, the engine making 14.86 revolutions. The time for hoisting was 30 seconds, while the time for loading and unloading was 108 seconds, or 3.6 times as long as the actual hoisting time. From the fifth to the twelfth revolution of the engine the speed is uniform, the engine making 0.8 revolution per second, while the ropes have a speed of 8.8 meters per second. Calculating the theoretical consumption of steam of the engine, it would be 338 kilogrammes. In reality, however, it required 820 kilogrammes, or an excess of 142 per cent. This enormous excess Herr Heim attributes largely to the cooling of the steam in contact with the sides of the cylinders and the surface of the pistons during the period of rest.—*Mechanical World.*

Extracts from Chordal's Letters.

SUPERFICIALITY IN MACHINERY.—ADAPTING MACHINES TO THE LOCALITIES WHERE THEY ARE TO RUN.—THE FUNCTION OF A TEMPLATE IN DUPLICATING SHOP WORK.—WHAT THE GANG DRILL WILL DO.—USING MILLING MACHINES IN GANGS.—THE PROBLEM OF CHANGING THE FORM OF A PRODUCT.—STARTING TO BUILD A SMALL ENGINE UPON THE MANUFACTURING SYSTEM.

Mr. Editor.

* * * Superficiality is a terribly long word, but that is the name of a charge frequently brought against the American product when compared with the product of Europe. It is a general sort of a term, and means everything and don't mean anything. In regard to machinery, it may mean not half made, or not half enough of it. About like saying, pretty good what there is of it and plenty of it such as it is.

The opposite of superficiality is thoroughness, and the test of thoroughness in the class of machinery I am referring to, or going to refer to, is to be made in view of an unmechanical class of users.

The builder who exports machinery to, say the South American countries, will quickly hear from his sales if the goods lack thoroughness of construction. What would be thorough in Michigan might not be thorough in Brazil. Our home machinery seems to be designed for sympathetic ownership and sympathetic handling. If we send this machinery among the Hottentots it will probably be good for nothing, while another machine of the same type, but of more thorough construction, will give them perfect satisfaction. Thoroughness does not mean elegance of appearance or perfection of workmanship, or specially heavy parts throughout, or an enlarged capacity; it means a thorough-going, reliable thing, regardless of capacity or of appearance.

* * * We find in Newark a fifty-horse Corliss engine doing its work day by day without giving any fault-finding cause. The engine is thorough; it is perfect. Ship this engine to the mines in Peru and it will be the last one you will ship. Too much superficiality in the engine.

* * * The word suitability should cover this whole question. The engine in the mines must be capable of producing rotary motion in unskilled hands; it must not break down under rough usage, and when it does break down it must be easily repaired by the local talent. Mere thoroughness will not secure these merits; suitability guarantees them.

* * * The English seem to have struck on a massive and even a clumsy system of design of agricultural machinery specially, which secures for it special favor as matter of export. The English portable engine has about it many points which would kill it in the American trade. But, still, I think the governing principle of their design would find more American friends on better acquaintance.

There is a class of engines built in this

country which are not expected to run for more than five or six hours consecutively. If put to continuous work on a good, heavy pull, their defects would soon develop themselves, and in remedying these defects we would probably find the engines tending in their form to the more clumsy English style. A solid, chunky marine engine on an ocean steamer, which must commence pulling the whole load at New York and keep it up till Liverpool is reached, is a fair sample of a reliable machine. Nothing nice, nothing delicate, nothing fine, nothing trappy or airy, or graceful, or beautiful; but simply massive chunks of the proper form which will stand every strain that can be imposed upon them.

* * * I have been told that a celebrated maker of steam fire engines once said that the lifetime of a steam fire engine was sixty days. This is the most impossible statement on its face that I have ever heard. It of course refers to engines of somewhat unmodern style, but still the statement might bear a little investigation. The question is, would a steam fire engine, after sixty days' aggregate running time, require for repairs a sum equal to its first cost? I don't believe it would, or anything like it. At the same time, it is well known that steam fire engines are a short-lived class. In these engines we have adaptation and superficiality combined.

* * * The fire engine boiler must produce steam quickly, and if it would only last to serve at two fires, such a boiler would have to be used. In this, durability is secondary, rapid steaming quality primary; economy of fuel is probably not worth considering.

* * * The modern locomotive boiler probably represents the most magnificent advance in steam engineering, but take this same boiler and put it in a factory and it is not a fine sample at all.

* * * In my last letter I had considerable to say in regard to the installation of the manufacturing system as illustrated in building sewing machines, chiefly with a view of showing the inapplicability of the system in its full breadth to any heavy and varied line of product. I think in that letter I confined myself to the motives of the system, and to the means for comparison or testing of the finished product. Really, I don't know but what the system ends there. I don't know that the actual making of the parts has anything to do with the system. It consists, after all, in the grand conception and intention of making the parts like a model, and of providing means for its execution within a prescribed limit of error; of course, one of the elements of the system is that the parts must be adapted to economical construction.

* * * Taking up the sewing machine narrative where I left off last week, we find a set of model parts determined upon and a set of gauges provided for measuring the new parts. If the old system of manufacture, such as was carried on when only one machine was made at a time, was to be applied to the new work, it would be found that no degree of mechanical skill could so construct the parts that even a fair percentage of them would pass the censorship of the gauges.

To illustrate this, let there be a piece of iron as big as your little finger, with a quarter inch hole in each end, the holes four inches between centers. Let test plugs be made for the end holes, with a limit of error of one-thousandth of an inch; let a test-piece be made with a pin at each end to drop into these two holes at once. Then have another similar test-piece a thousandth of an inch more between centers. Here we have limiting gauges for this piece, so far as the holes are concerned. Taking the plug gauges—if the big plug goes in the hole, the hole is too big; if the little plug won't go in the hole it is too small—the holes must be of such a size as to admit the little one, and not the big one. If the long tram-piece will drop into the holes, the holes are too far apart. If the short one won't drop in, they are too close together. The little one must drop in, and the big one must not. Tip-top, good workmanship can produce these holes of such uniform size as to properly pass the plug gauges. And this can be done with ordinary tools; that is, simply drills and reamers for making holes. The skilled workman will prick-punch these holes, and drill them, and ream them, and they will be all right; and he can do this with one piece or with one thousand pieces, without using anything in the way of what is known as a special tool.

When it comes to getting these two holes the proper distance apart, skill fails entirely. The man does not live who can drill two quarter-inch holes in twenty different pieces and have them all the same distance apart, within a thousanth of an inch variation.

This piece of iron, then, imperatively demands in its construction something besides ordinary tools and extraordinary skill. The something besides is a mere template through which to drill. The template is made to fit the tram-gauge and the holes drilled through it will all be the same distance apart. If it was not for the wear of the template the pieces might be depended upon as accurate without the formality of the tram-gauge test.

* * * When this little template steps in, the skilled man steps out. A mere laborer, with proper drills and this template, can accomplish what the most skilled workman cannot accomplish without the template. He can drill these holes a uniform distance between centers.

* * * Here we have the case of a special tool, a template, designed not primarily to cheapen the article, but to fulfil the absolute requirements of construction. Incidentally the template reduces the cost of labor to almost nothing; I might say the cost of skilled labor in this particular to zero. I believe that the common laborer will accomplish more with such a template than the skilled mechanic will do with it. I may be mistaken in this, but such is my own experience with special rigs.

* * * Assuming that this piece of iron, instead of having a quarter-inch hole in each end, had a quarter-inch hole half-way through one end, and a three-eighths hole all the way through the other end, with a half-inch counterbore half-way through. Ordinary drilling facilities will drill these holes by the aid of a template, but we quickly see that, taking one piece in hand, it requires the drilling machine to be stopped three times to have new tools inserted, and accurate depth gauging is to be done at each operation; or else that one drill be kept in the machine, and the piece handled about five times, the template being removed each time.

Here a change is suggested in the mode of operation, simply by a desire for economy. A gang drill is brought into play. Here we have several spindles running continuously—one with a quarter-inch drill, one with a three-eighths drill, one with a half-inch counterbore, and, maybe, tools to follow up the first tools and put a final finish in the holes. The work can only be fed upward so far, and each of the tools projects downward an exact distance. Therefore none of the tools can cut below a certain depth. By this means, the machine itself acts as a depth gauge, subject, of course, to the approval of suitable limiting gauges for measuring all these depths. The piece and its template, once taken in the workman's hand is passed from spindle to spindle and laid down completed by a practically continuous operation. The machine has done little which the skilled laborer could not do with one drill, but it has done much more of it without the aid of skill.

* * * It is hardly proper to any longer call the gang drill a special tool. It may have been devised originally to drill these very pieces of iron that we have been speaking of, but it is found capable, without any modification whatever, of application to any class of work of light character having numerous holes of different sizes. It thus passes out of the range of special machines and becomes simply a gang drill, a general tool in the shop.

* * * Notwithstanding its general utility, the gang drill is little known outside the manufacturing localities. Many mechanics who have heard of gang drills and have seen pictures of them, and who, may be, have had a passing glance at the machine itself, are under the impression that the gang drill is a machine with several spindles, which may be adjusted around in some shape so as to drill several holes at once. They think the pieces of iron previously referred to have both ends drilled at once in a gang drill, have the distance between the centers of the holes regulated and the work done with dispatch. This impression is very common—almost universal. There are machines made in which several drill spindles operate at once, but they are not gang drills. They are multiple drills, I think. Examples may be found of machines for drilling the bolt holes in the end of railroad iron called rail drills, and in the machine for drilling the six holes at once in the arch bars of railroad car trucks called arch bar drills, and in numerous machines for drilling lots of screw holes in common hardware.

* * * I have never heard of a multiple drill system being applied to sewing machine work, where absolute accuracy was required in the distance between centers of holes, with a hope of dispensing with templates.

* * * In operation of the milling machine upon sewing machine parts there are two features peculiar to the manufacturing system. One feature is the marvelous variety of work which the milling machine is made to do to the suppression of file and planer work. The other is the subdivision of the cuts. In this latter feature we have the same economical requirement as in the drilling operation which developed the gang drill. A certain piece may require fifteen different milling cuts upon it which cannot be done at once. If a series of the pieces be passed through one operation, and then the machine is changed and made to take the second kind of a cut, and so on through the fifteen operations, we will find that cutters, and holding fixtures, and what not, have to be changed fifteen times in the machine for each lot of pieces passed through the entire series of operations. More than this, there is a refinement of adjustment required in arranging cutters and holding appliances. This fine adjustment once accomplished is not to be disturbed without thought.

The modern manufacturing system arranges fifteen milling machines in a row, adjusts each machine to a nicety, and passes the work on from one to another till done. This is the gang drill again with a variation.

* * * The milling machine capable of performing the fifteen different operations upon the piece would be a marvelously complex and expensive contrivance; one not to be placed in the hands of even ordinary mechanics.

In the fifteen machines referred to each of them is required to perform but a very simple operation. Each of the individual milling machines may therefore differ from its fellows, and each may possibly be of a very simple and inexpensive character.

Here we have veritably the special machines. The seventh machine in this row, while perhaps a very common and simple affair, may be capable of taking a certain peculiar little cut in a certain peculiar little piece of a certain peculiar sewing machine, and it may not be worth ten cents for anything else in this world. Make a change in the sewing machine, or in this little piece of it, or in this little cut in this little piece, and this machine becomes valueless. It is a special machine in the strictest sense of the word.

* * * Here we run afoul of a broad question of policy in altering in any manner any detail of a manufactured product when made by special machinery. And here we see the important part played by the test of the model on which the whole scheme was based. If faults develop in the sewing machine manufactured, due to a fault undiscovered in the working of the model, behold the trouble which may be caused in the factory system.

* * * With this in view we can readily understand why the sewing machine manufacturer postpones his alterations in detail after such alterations are found desirable, until enough such alterations accumulate to justify the construction of a new model and an overhauling of the entire factory system. Such grand changes must only occur at long intervals. A product which can be made and rendered more salable and satisfactory by a certain change, does not necessarily justify the immediate change. Experience and calculation must show that the profit due to the added sales will justify the grand expenditure made necessary by the alteration.

* * * I assume that any reputable manufacturing concern in this country is always a fair subject of discussion in the columns of such a paper as the AMERICAN MACHINIST, and while I seldom mention names, I certainly always feel at liberty to express my admiration or criticism of a manufacturing concern or its product. I therefore take the Wheeler & Wilson sewing-machine as an example to illustrate the feature of change.

The old Wheeler & Wilson sewing-machine had a rocking needle arm, a curved needle and a feed path across the front of the operator. The needle had to pass the hook exactly so. It was hard to put a curved needle into the machine so that it would pass the hook exactly so; therefore, a soft needle was used which could be sprung or bent into proper position. A curved needle is a weak needle. Across one's bows is not the way to sight a straight line. Unskilled operators would not bend this needle right. Unskilled operators would put a short bend in the needle and crowd it too hard and break it. Unskilled operators would sew crooked seams. Skillful operators would do none of these things and were capable of recognizing the merits of the machine. With all its excellencies these defects were bound to meet with some recognition. But no prudent business policy would justify small changes in a machine being manufactured upon such a perfect system and in such perfect manner as was this magnificent Wheeler & Wilson. Instead of attempting to remedy these defects in design it was probably thought a better policy to screen them under added excellencies of workmanship and under a more vigorous advancement of its faultless features. The machine was not turned around one year so as to feed the work from the operator, and the next year provided with a straight needle, and the next year with something else, but when the proper number of years roll round, and the time for change as determined by prudent manufacturing policy has arrived, the whole thing is restudied, with established excellencies in view and with a cure for every known defect in contemplation. I never was in the Wheeler & Wilson factory, and have no idea how much of a change was caused in the tools when the new machine was brought out, but, I dare say, it bore a very respectable relation to the cost of outfitting for an unknown machine.

* * * A friend of mine, one of the best mechanics in the United States, by the way, showed me a small steam engine which he proposed to build upon the manufacturing system, so far as that system would be justified by the character of the machine. There were but few sizes; they were to be built in large quantities, and the general design seemed to fit it peculiarly for the operation of special machines. The gentleman referred to had nothing to do with the design of the machine. He was to be merely the manufacturer. I saw him a short time ago, and on his own premises, but saw very little which looked like special appliances. I asked the cause, and was answered without words. I was shown a big tapering hole in a part of an engine, and then I was shown a big pile of magnificent reamers for producing these tapering holes for the various sizes of engines, and then I was shown another one of these same parts, and behold! it had a straight hole in it. Expressed in language, the story will read as follows: The model has a taper hole in it; here are five hundred dollars' worth of reamers to make the taper hole, and fifty dollars' worth of gauges to test the taper hole. Before the tools were done we abandoned the taper hole, and the question arises whether it will pay to commence the special tools for the straight holes?

* * * * *

Very respectfully CHORDAL

Securing Core Vents.

BY THOS. D. WEST.

In making a mould for any casting, many of the operations may be described as those common to the art of moulding, while in some instances new operations may be required. A good deal of trouble results from neglecting the things that are common, for which there is no reasonable excuse. For bad results, when new points are involved, there is sometimes reason for judging lightly. The proper securing of core vents is one of the things too often neglected, and one for which the core-maker is not unfrequently unjustly blamed. To show how easily castings may be lost through lack of proper attention, I will return to the subject of cylinder cores.

At *K* is represented a core ready to be set in its print, while at *E* it is represented set in place. This is no exaggeration, but an example from actual practice. Paste is often a very useful substance for assisting in securing vents, but it should be used with discretion or it may defeat the end it was intended to accomplish. Looking at the core *K*, it will be seen that the core-maker has made a good vent, but that the vent holes are stopped up with paste, as shown at *E* and at 2.

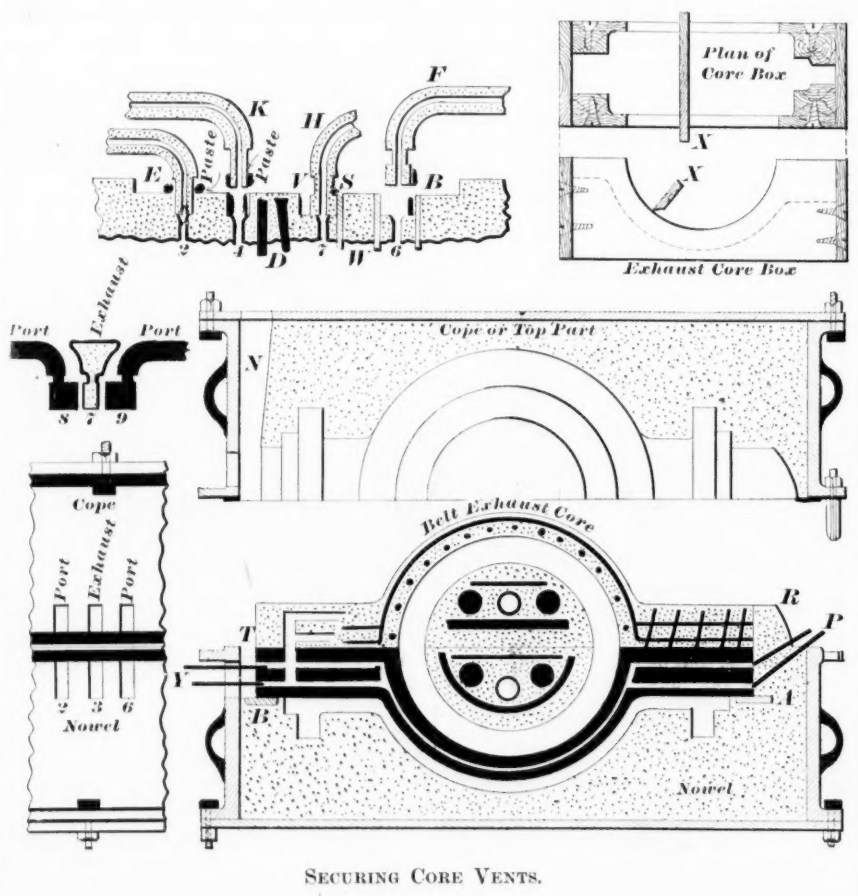
The less paste that can be used the better, as it is not only liable to clog up the vents, but also to blow or cold shut the casting. My idea of the way to secure such cores is shown at *H* and *F*. Before permanently setting the core, it is set in its print to see if the side *B* will form a close joint along its entire length. Should it be found not to fit properly, it should be made to do so, either by filing or by building up the print with loam or thick blacking. When built up, if the built-up part is more than $\frac{1}{8}''$ thick, it should be dried, either by using a hot iron or in the oven. When ready paste may be applied to the side that cannot be readily seen, as *B*. The paste should not be more than $\frac{1}{8}''$ thick, as if the core is properly fitted this is ample. Sometimes it may be advisable to put the paste on the mould, and again, it may be better to put it on both the mould and core. If both mould and core are warm, it is better to apply the paste to only one of them, as by dividing it between both it is likely to become dried so as not to form a joint. Where both mould and core are cold, by dividing the paste between them there is not so large a body from which the print end of the core will absorb moisture, thereby weakening it. In my practice I always endeavor to have either the mould or core warm, to dry the paste.

A good mixture for paste is flour wet with black wash, which may be either thick or thin, according as thick or thin paste is wanted. Clay wash may be used instead of the black wash. The clay wash is good to keep the metal from burning away the paste and finding its way into the vents. Where there is danger of the paste coming to the surface of the mould, in places where it cannot be seen or come at to scrape off, I prefer the black wash, as it is not so liable to blow or cold shut the casting as the clay wash.

For setting cold cores in green sand moulds I prefer to wet the flour with machinery oil, as there is not so much danger of chilling or generating steam as there is when the clay wash or black wash is used. Rye flour is the best for paste, as it is not so sticky or clammy as wheat flour paste. As regards the thickness or consistency of the paste, it depends somewhat upon circumstances, but as a rule it should be so thick that it will not flow.

Another important point in making and using paste is cleanliness. It is a common thing to see a moulder using paste mixed in a dirty pot, and containing foreign matter, such as dirt, stones, &c., and hard, dried paste from the sides of the pot. In mixing paste the pot should be quite clean, and the necessary care should be used to provide against the introduction of any foreign matter whatever. Every evening it should be some one's business to see that the paste-pots are thoroughly cleaned of the paste sticking to the sides, and filled with water, which will prevent the paste from drying. When wanted, if the paste is too thin it can easily be thickened by the addition of more flour, which should be carefully sifted.

At *H* is represented the core *F*, permanently set in its print. At *V*, a space is left open, which it is often advisable to do at the ends of the cores. The width of this space should be not less than $\frac{1}{4}''$, nor more than $\frac{3}{4}''$. In horizontally moulded cylinders, with valve face, it is generally objectionable to make the print ends of the pattern the same size as the print ends of the cores, as at *E*. In some instances it is not practicable to leave a space, as shown at *V*, as there is no chance to come at the prints when the cores are set in. In such cases the pattern prints should be about $\frac{1}{8}''$ larger than the print end of the core box, and when setting in the cores see that there are no projections on the print ends. Use just sufficient paste to make a reliable joint. I prefer in such instances to use the paste only on the core, as at *K*, as there is not the same danger of the paste being forced into the vents as when it is applied to the mould, as at 4. There is, of course, a possibility of the paste being



SECURING CORE VENTS.

squeezed to the surface of the mould, as shown at *E*, but if care is used the amount will be very small, if any.

Setting cores in the way just indicated requires the exercise of skill and judgment, and the plan should be avoided when that shown at *V* can be employed. By the latter plan there is an opportunity to see what is being done, and certainty is made to take the place of guess-work.

When the core is being set in the print for the last time it should be kept over to the side *V*, that the paste, shown at *B*, will not be scraped up, as at *E*, or squeezed down into the vent outlets at 2. When the core is down it is then pressed tightly against the side *S*. The space *V*, should then be rammed up with new moulding sand wet with beer, or if the mould or core is warm enough to dry it, loam or blacking daub may be used, as it will bake so as to hold the core more firmly. The advantage of the beer and sand is that no time is lost in waiting for it to be dried in a cold mould.

To mix the beer sand, take new dry moulding sand and wet it with the beer so it will be as damp as sand for making green sand moulds. The reason for using dry sand is that it may absorb sufficient beer to give it strength. When loam or daubing is used it is made by mixing blacking dust (same as used for making blacking or for dusting green sand moulds) with an equal quantity of parting sand. When thoroughly mixed the mixture is wet with medium thick clay wash. The clay wash gives body, and the parting sand makes it open.

This is a good mixture, not only for the purpose named, but also for patching up moulds and the joints of cores. I have used it for daubing up the joints of column cores cold, setting the cores in the moulds without drying. Whatever dampness may have remained was provided for by the porous character given it by the parting sand. When used for patching the surfaces or corners of moulds, it is better for being dried and blacked over, as this insures a smooth surface on the casting, which might otherwise be rough from the iron penetrating the parting sand.

To hold the small body of sand between the core prints, some use nails or rods, as represented at *D*. This is a poor plan. At *W*, is shown a much better one, as it not only holds the sand firmly but gives a solid print that will not be broken in setting in or removing the core. It also helps to hold the cores in place. The plates (at *W*) are of iron about $\frac{1}{4}''$ thick, and long enough to project about 2″ beyond the ends of the print. Their depth is about twice that of the print. The face edge of the plates can be kept $\frac{1}{4}''$ away from the pattern, although they are generally placed upon a little sand sifted on it, the plates being wet with clay wash to make the sand stick.

In the large engraving of the section of a belted cylinder mould, two plans of securing cores are shown. At *Y* is represented the plan I prefer. Numerals 2, 3 and 6 show openings made in the flask opposite the exhaust and port core prints. When the cores are all set and the outside joints doubled up, the open space T is rammed up with sand. After the sand is rammed up to the first row of vent holes they are cleaned out, and short vent rods put in them. Then more sand is rammed and the second row of vent rods placed, and so on till the joint is reached. (These rods can all be placed before commencing to ram up if we avoid hitting them.) When the cope is on, the vent rods are placed, and the sand is rammed through the opening provided at *N*.

Sometimes circumstances will not admit of the vents being taken off through the cope. In such cases it is often advisable to connect the upper portion of the core vents with the lower, as represented in the top and bottom parts of the belt core. Where the cores are not pasted together, this is somewhat difficult to accomplish; but by referring to the article, "Making and Venting Cores," AMERICAN MACHINIST, June 16, the plan of connecting vents will be understood.

At *P* is shown a plan for taking off vents, which we may be obliged to use when the flask is not adapted to the job, or when the pattern is not properly made.

Whenever the joint of a mould must be raised above the joint of the flask, as shown at *R*, the more room there is to mount a strong body of sand, the more likely it is to keep its form and to support the cores, etc. This plan of moulding is not always objectionable, but unless there is room sufficient for the vents to be cared for within the body of the mould itself, and then all led off through one opening, there should be openings in the flask, as shown at *Y*, 2, 3 and 6.

Taking off vents through the joint of a dry sand flask, as shown at *P*, is by no means reliable. It would be much better to drill holes through the sides of the flask for the purpose.

When the face of a cylinder is moulded as here shown, it is often advisable to have the cores form their own prints, as at 7, 8 and 9 This plan saves work in rodding, and labor in setting and securing the cores.

The exhaust core box shown is a handy one for cores made in halves.

LETTERS FROM PRACTICAL MEN.

Cutting Worm Gears.

Editor American Machinist:

In your issue of May 26th, I notice a communication from "Spiralis" about cutting worms and worm gears. After disburdening his mind of various thoughts concerning "polytechnic schools," "old-fashioned machinists," "fertility of expedients," "soap and candles," etc., he comes to the pith of his communication and describes how the worm and wheel were cut.

The worm was possibly cut in a modern lathe, but we are assured that the wheel was operated upon in that terror of modern machinists, an "old-fashioned rattletrap of a gear-cutter," that "had not been used for years," and would not swing over to cut spirals." We have one in our place, and use it for facing nuts.

After spacing the wheel blank with a V cutter, apparently just marking it all round, he puts a cutter, having a thread on it the same pitch and same shape as the thread on his worm, on the arbor of the machine, and lets his blank run loose on the centers, trusting to the angularity of the thread on the milling tool to turn the blank around. The cutter is fed into the blank until a perfect tooth is formed on the wheel, the wheel turning round underneath the cutter until this end is arrived at; and, according to his account a fine job was the result.

Now, Mr. Editor, I am a machinist of the present generation, and would insinuate, "Spiralis" to the contrary notwithstanding, that this "wrinkle" is as well or better known among the present race of machinists as it is among the "fast disappearing race." But we younger ones reject the rig because we find that, although looking at it superficially it appears to promise favorably, yet it does not "pan out" well at the finish for this reason:

We will suppose the wheel to be accurately spaced for say 40 teeth, and pitch six to the inch, as in the instance noted. The wheel has revolved once under the milling tool, which is now fed in. The periphery at the bottom of the teeth on the wheel is, as the cutter is fed in, continually getting smaller, but the pitch of the thread on the milling tool remains the same. It follows, therefore, that, as the distance between each tooth grows less as the cutter advances to the center of the wheel, and the pitch of the milling tool remains the same, the points of the teeth on the cutter crawl up on the sides of the teeth being cut in the wheel, and cut them away, so that if the wheel was allowed to revolve under the cutter long enough, the teeth of the wheel would be all cut away. Such is my experience.

I have, however, succeeded in making a passable job by cutting the teeth in the wheel blank with an ordinary cutter to within $\frac{1}{32}''$

of the finished size, and then running the threaded cutter over *once*, taking a light shaving off, but even then there would be a loose place where the worm would shake, that place being where the cutter completed its revolution. M. S. WILLIAMS.

Risdon Iron Works, San Francisco, Cal.

Measuring the Clearance in a Steam Engine Cylinder—Making Thirty and Sixty Degree Angles—Diameter of Steam Pipes.

Editor American Machinist:

The following method of measuring the amount of clearance in an engine cylinder appears to me to be better than any I have seen described, inasmuch as it reaches the desired result in a simple and direct way, without reference to tables or the use of mathematics:

See that the piston and valves are made tight, and the valves disconnected; arrange to fill the clearance spaces with water through the indicator holes, or holes drilled for the purpose. Turn the engine on the dead center; make marks on the cross-head and guide that correspond; weigh a pail of water, and from it fill all the clearance space. Weigh the remaining water, so as to determine how much is used. Then weigh out exactly the same amount of water, turn the engine off the center, pour in the second charge of water, and turn back until the water comes to the same point that it did in the first case. Make another mark on the cross-head, and the distance between these marks is exactly what you really wish to know; that is, it is just what piston travel equals the clearance.

To some of your readers this may not be new; others will understand it at a glance, but, for the benefit of your younger readers, it may be well to add a few words, and if possible make it more intelligible.

When a piston comes to the end of its stroke, it does not quite hit the cylinder head, and the space between it and the cylinder head, together with the ports and passages, is called clearance space. This being very irregular in form, is generally difficult to measure and calculate. In figuring an indicator card, it becomes necessary to know what proportion this clearance space bears to the stroke of the engine. If it takes one pound of water to fill this space, and to admit another pound of water, the piston must be moved one inch, then the clearance bears the same relation to the capacity of the engine as one inch bears to the stroke of the piston. Thus, under these circumstances, in an engine of ten-inch stroke, it would be said the engine had ten per cent. clearance.

* * * * * * *

Thirty-odd years I have been working in the wood shop, draughting room and machine shop; have wanted a 60-degree angle a thousand times, and knew no way but to go for a triangle, protractor or compasses. I supposed I knew a good deal about triangles, short cuts, etc., but was quite chagrined the other day, when I discovered that with a rule, the square corner of a board, or a piece of paper, and something to mark with, one has all he wants to draw a 30 and 60 degree angle.

With a 12-inch rule, measure six inches from one corner of the board, and make a mark. With one end of the rule at this mark, and the other end touching the bottom edge of the board, make another mark. From these two marks draw a line, and it will be 30 degrees from the bottom line, or 60 degrees from the side.

Everybody knows all about this way of doing the thing, but who has been doing it for years with a common rule without telling of it?

* * * * * * *

The question of how large a steam pipe should be for a certain sized engine is a pretty common one, and one often answered with as much confidence as a question in addition, when, in fact, the length of the pipe and the percentage of decrease in pressure the party is willing to submit to are factors having as great bearing on the question as the size of the engine—in fact, more than the size of the engine cylinder, as that has nothing to do with it until the speed of piston is given, and horse-power is not a positive factor until the economy of the engine is taken into account. Steam will pass through a short hole and maintain nearly the same pressure on both sides, while it will not travel through a long pipe at any great velocity, unless the pressure is lower at the outer end. Hence the size of the pipe to give an approximate boiler pressure in the engine depends largely on its length.

The common idea that a simple test of pressure is a true measure of loss in long pipes must be erroneous, as it is only a measure of the friction in the pipe at that velocity. The condensation may be, and probably in many cases is, a much larger loss than the loss by friction.

JOHN E. SWEET.

Selecting Gears to Cut Screws.

Editor American Machinist:

In your issue of June 2d, "Machinist" seems to think that Chordal is doing the average machinist an injustice when he says that only two in twenty can be found who are able to calculate the gears for screw cutting. Probably a good way to settle that question would be for a subscriber from each shop throughout the country to take the trouble upon himself to give us through the columns of your paper the number of machinists in his shop, and what proportion are able to make the calculations. I will start the ball rolling by saying that where I am at present employed there are twelve of us, all practical machinists. Four of the twelve can make the above calculations. Two of the twelve are the bosses and owners of the shop, who work at lathe, planer, and vise as hard as the rest of us. But neither of the two is able to make any mechanical calculations. They always depend on their employes for such work.

My first job in this shop was chasing some large screws 6″ diameter, one thread to the inch. While I was working on these screws, one of the bosses came to me and said he had received an order for a screw of the same diameter, but with a fractional thread—one and one-quarter threads to the inch. I inquired if he had the gears. Said he did not know, but would tell me how to find out. "You go to the scrap pile and get a piece of iron, put it in the centers of the lathe, put on certain gears and run a cut over the iron. If that does not answer, change for another set of gears and try that, and so on until you find the right gears."

"And what if I don't find the right gears?"

"Well, then we will make a gear that will cut it."

While he was telling me how to find this gear I was making mental calculations, and when he had concluded his instructions I told him that if he had a sixty wheel and a twenty wheel we could cut the screw.

"How do you know it will?" he inquired, with much astonishment.

I remarked that figures would not lie.

He looked over the gear rack and found the wheels, laid them on the lathe board, whirled on his heel and walked off without a thank you.

I have often wondered since then if he had been obliged to make a wheel, whether he would have used the same cut and try system, *i. e.*, make a new wheel and then put it on the lathe and try it to see if it was right. MENTAL.

Wheeling, W. Va.

Lathe Boring Attachment.

Editor American Machinist:

I inclose a sketch of a boring apparatus, with description. This device consists of a bar (shown in Fig. 1) 2″ in diameter, and about two-thirds the length of the lathe-bed.

A long sleeve *B*, is firmly secured to one end of this shaft, the end of which projects into sleeve *B*, about 2″. The rest of the sleeve *B*, is bored its entire length to freely admit the boring bar *C*. The length of *B* should be a little greater than the distance required to bore, plus the 2″ filled by end of the bar. *D* is a driver of flat iron, about 2″ wide, semicircular in section, bolted to the sleeve A common lathe dog *E*, is placed on the bar. The collar *F*, is held in position by a small thumb-screw; *G* is the cutter and key, made in the usual manner. A groove *A*, is turned in the sleeve *B*, and of a width

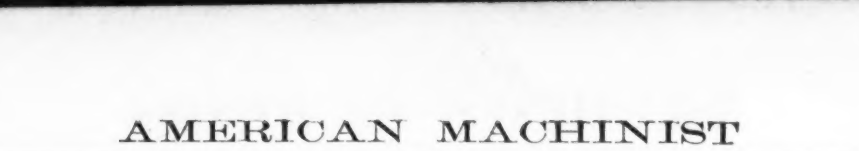


Fig. 1

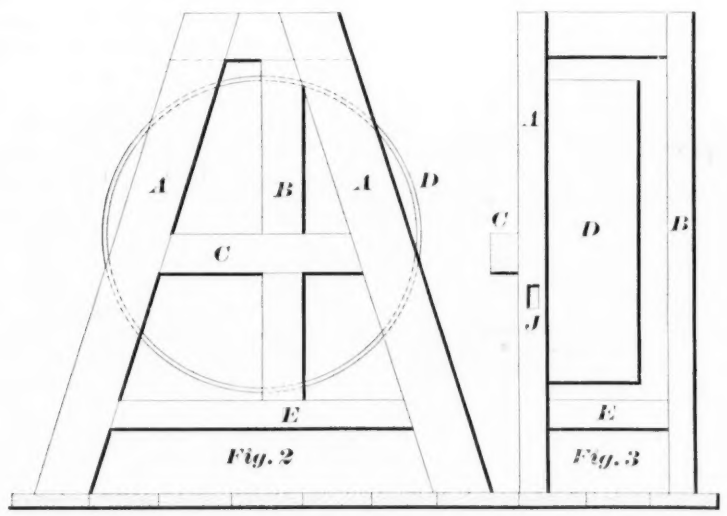


Fig. 2

Fig. 3

LATHE BORING MACHINERY.

to fit the jaws on steady rest. The holder *H*, is slipped over the boring bar *C*, and is used to feed it, by holding it in the tool post, and pressing against the collar *F*.

The boring bar *C*, runs through adjustable boxes, bolted to wood pieces, *B* and *C*, Figs. 2 and 3, but is not shown in my sketches. In operation this frame-work is bolted to the end of lathe bed, taking care to have the faces square with shears, with the boring-bar boxes in line with lathe centers laterally.

Fig. 2 shows a view of attachment looking endways of lathe bed toward the head block, and Fig. 3 a side view. The letters in Figs 2 and 3 refer to like parts in both. This frame work should be made of very hard, well-seasoned timber, thoroughly bolted together. When bolted to the lathe bed it should have the faces on which the pulley or gear is to be bolted exactly at right angles with the shears. The faces of *A*, *A*, are covered by strips of flat iron $\frac{1}{8}'' \times 3''$, to prevent the edge of pulley *D*, or other work, from setting into the wood when the bolts are tightened. The frame is secured to lathe bed by two hook bolts catching over the planed part of bed between the V's, and passing through a stout iron strap let into the pieces, *A*, *A*, at *J*, Fig. 3. There is also a strong bolt passing through *E*, and the opening cast in the leg of the lathe. The pieces, *A*, *A*, are bolted to the floor to prevent the action of the tool from raising or tipping the frame. A mandrel made of the same diameter as the bottom of groove *A*, in the sleeve *B*, is placed on the centers, and the jaws of steady rest set to just touch the outside of mandrel. The tail-stock is then removed and steady rest placed in position on the V's to carry sleeve *B*. The opposite end of the bar should be hung on the live center, with a dog to drive from face-plate, and the boring bar *C*, slipped through the boxes on frame, and through the work, which can be placed near enough true to admit of this being done. The collar *F*, and dog *E*, also loose collar, with extension *H*, should then be slipped on the bar, and the end of extension *H*, placed in the tool post. The bar is then slipped back in sleeve *B*, until it strikes the end of the hole. Should the hole to be bored not be long enough to require it, the dog *H*, should be screwed up close to a sleeve *B*, and the collar *F*, set in position. The work can be set true by the use of a tram, or any other method preferred, and bolted. The cutter *G*, should be set and the lathe started. The driver *D*, will communicate motion through the dog *E*, to the bar *C*, and the feed of lathe carriage *G* being thrown in the extension *H*, pressing against collar *F*, will feed the cutter through the work, while the dog *E*, is free to slide the length of carrier *D*, until the end of the boring bar is nearly out of the sleeve *B*, when the dog *E* should reach the end of *D*, and rotary motion cease before the bar comes entirely out of sleeve *B*. A key-way and spline could be used for driving the boring bar instead of the driver and dog, and would perhaps make a neater arrangement, though I think the operation would not be any more satisfactory. My frame is about 4″×5″, though heavier timber would be better. A circular face-plate of iron, to take the place of the framing, would be still better, but would, of course, be more expensive. My boring bar is $1\frac{1}{4}''$ diameter, having occasionally to bore small holes in work of quite large dimensions outside. Should the class of work admit, the bar could, of course, be made heavier to advantage.

Niles, Mich. WM. M. MOORE.

True Economy in the Use of Belts.

Editor American Machinist:

There have appeared lately in the AMERICAN MACHINIST several able articles on belts, and there are but very few who read them that did not receive some benefit in regard to arranging and keeping belts in order so that they may be less expensive.

For the last fifteen years I have been engaged in running wood-working machines, and generally kept the belts in order throughout the mill. I think it may be safely said that wood-working machines are harder on belts than any other class of machines, because they must run at high speed, some cutter heads making as high as 7,000 revolutions per minute. All my side cutter belts on flooring and moulder are endless, and I have no trouble in making and keeping them so; nor do I use a new belt long until all the rivets are gone.

It seems belt makers use only common glue, then rivet the laps. After such a belt runs a short time the joint opens, the rivets pull out and the belt (or at least a part of it) is ruined. My plan is, just as soon as a joint gives away, to cut the rivets out, clean the lap and put it together with a cement I use, without rivets, and it will never come apart if properly put together.

Sometimes I gather up all the old pieces of belts, trim them up and cement them together and thus make a belt that will last for years. If I hook a belt of this kind I cement a short piece of new belt to each end and use Blake's brass belt studs; then I have a belt in many respects equal to a new one.

I have seen belts in mills that were all pieces; one joint was laced and another had steel hooks. Such a belt cannot wear, but will injure the machine and do the work imperfectly.

We have a double surfacing machine. The belts that drive the cutter heads are 5″ and heads make 4,200 revolutions. I always had a great deal of trouble with these belts, but since I have them endless I have no trouble at all.

Belts are expensive, hence they should

receive the best attention. A great many mill owners have no idea what a belt can do or what can be done with it. In some mills every one repairs belts that break, and the result is the proprietor buys belts enough in one year to run his mill two years.

Again, I have seen belts of double thickness run over pulleys making 4,000 revolutions, which is wrong. Such a belt will hurt the machine and will not last as long as a belt of single thickness.

The best of belts should be used in planing mills.

About one year ago I got a new belt 5″ wide by about 25 feet long, a driving belt for an 8″ moulder, which on an average runs only one day out of six. The loose pulley is 2″ smaller than the tight one, and I am safe in saying that I have cut out at different times 15″ of belt since it has been in use. Instead of 5″ it does not measure 4¾″. The result will be that it will not wear nearly as long as it ought, and in fact its cost was more than that of good belting.

Some time I may give you for publication the receipt for making the cement mentioned.

D. E. SHRECK.

Manayunk, Philadelphia, Pa.

The Apprentice Question Plainly Stated.

Editor American Machinist:

The death of the old apprentice system, as was announced in the AMERICAN MACHINIST not long ago, seems to be a well-recognized fact, and the public mind appears to be seeking for some other system which shall enable meritorious young men to acquire trades, and thus supply employers with skillful and reliable workmen.

In forming a new system, it may be well to bear in mind the cause of death in the old. Doctors may disagree as to what this cause was, and the intelligent jury may ascribe it to the ways of a mysterious Providence, as has been done in many other cases of starvation; for the late apprentice system died of starvation, pure and simple.

The time was when the apprentice lived with his employer as one of the family, having his board, clothing, attention in sickness, and some of the comforts of a home assured him. If prices went up or down it was all the same to him, and he could devote his best energies to learning his trade and in the interests of his employer.

His life was not one eternal, horrid grind to find ways and means to provide board and clothing.

The number of apprentices that could be taken on this plan was limited, and the progress of events requiring more learners, a stipend was agreed upon, or rather apportioned to the apprentice in lieu of board and clothing—he to provide for himself.

This stipend seems to have been based upon what the actual cost of his keeping had been to his employer, for when he came to pay board and pay for clothing, to those who charged a profit, his cash came short, and he was face to face with starvation.

I have contributed a share to this starvation process. I have employed apprentices; good boys, too, at fifty cents a day for the first year, when I knew that they could not get board at less than three dollars a week. I was ashamed of it then, and am yet; but it was the customary price; competing shops did the same thing, and I was too greedy to pay any more. Barely enough to pay board when making full time, I believe, has been the rule, or at least the practice, for the first year, all over the country for the last quarter of a century. With such pay, where is clothing to come from? How are books, papers, or even a postage stamp to be procured?

A week's sickness would leave him hopelessly behind with his board bill and in debt to the doctor.

Many a runaway apprentice can date his first idea of desertion from a brief illness which left him hopelessly in debt.

The man of whom I learned my trade served a seven years' apprenticeship, from the age of fourteen to twenty-one. It is not likely that a boy of fourteen would be worth his board and clothing to work in a machine shop; but let him go to school, or work at whatever he can find to do, until he is eighteen, and then, if he cannot earn the bare necessaries of life the first year, he is not of the right material to make a machinist of, or else his employer is not the right kind of a man to have charge of apprentices.

In the so-called learned professions, the student can leave his studies and go to work for wages until he has some money saved up, then resume his books or lectures as if nothing had happened, but the apprentice must keep right along on one continuous course or be branded as a runaway.

Men of means could afford to send their sons to a machine shop to learn a trade on even less favorable terms than their board, just as they could send them to school or college, but it is well known that apprentices with rich fathers do not generally make the kind of skillful workmen that are most desirable. They are too uncertain; not caring whether they work or not, after they have once learned how and the novelty of the thing has worn off.

It is the youth who expects to earn his bread by the sweat of his face [no brow] for long years to come, to whom the employer should look in recruiting the ranks of skillful and reliable workmen.

There are plenty of such young men, who would gladly give three years of faithful work for the sake of learning a trade, if they could only be assured of a simple maintenance during their apprenticeship; and any system which does not provide for the reasonable maintenance of the apprentice will be a failure.

F. J. MASTEN.

Making Diagrams of Valves.

Editor American Machinist:

Your correspondent, W. S., Baltimore, writes that he has a plain slide valve engine with single valve. The cylinder is 12″ diameter by 14′ stroke; revolutions 100 per minute; stroke of valve 2⅝″; steam ports and valve, as per Fig. 1, viz.: steam ports 1″, exhaust port 1 5/16″, bridges 1⅛″, lap of valve ⅝″, inside lap 1/16′.

The above arrangement of valve cuts off the steam 1″ from end of stroke and exhausts at ¼″ from end of stroke, giving a card something like Fig. 2.

By altering, as shown in Fig. 3, he would get a card something like Fig. 4, as the valve *same travel* (2⅝′) would cut off at 5/8″ from end of stroke and exhaust at 1½″ from end of stroke.

Lap shown in Fig. 3 is ⅜″, and no inside lap whatever.

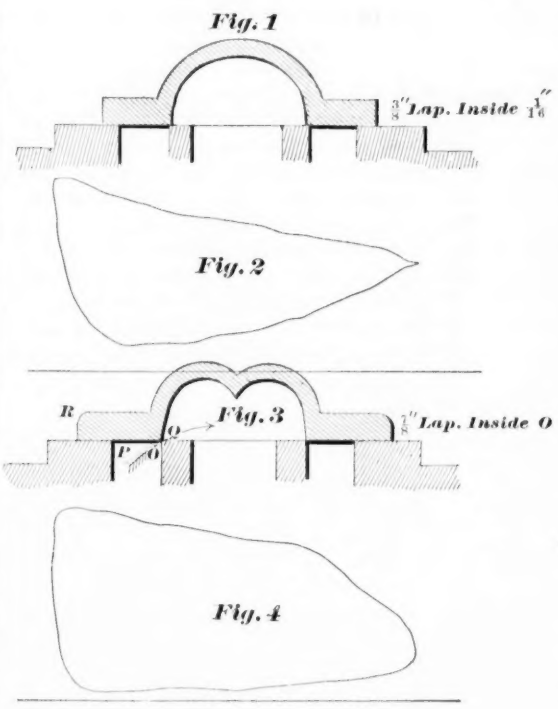
There are two methods employed in deciding the dimensions of a slide valve. One is to slide the thumb along the rule, first one way then the other, untill a figure hap-hazard is decided upon for the steam lap, and another figure hap-hazard for the exhaust lap.

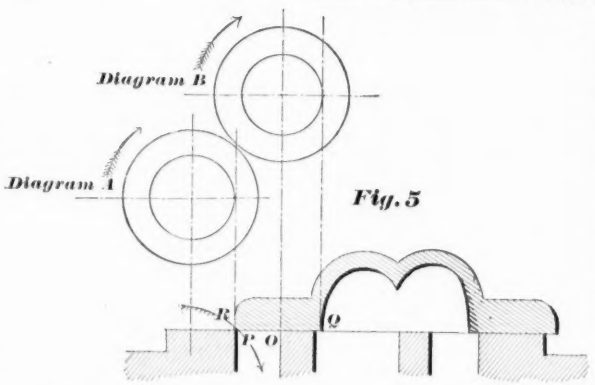
Another way is to decide in advance what disposition of steam is to be made in the cylinder, and make the valve to do it. The latter way is the better of the two.

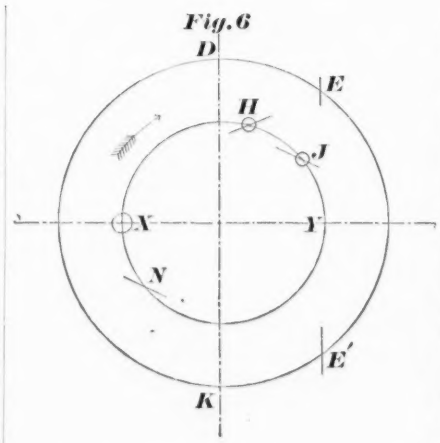
After all that has been written on this subject, builders that supply engines like that of W. S. have no more excuse for such work than if the subject stood explained perpetually on the face of the moon.

If your readers will follow the explanation of diagram Fig. 6, they will have a rule simple enough never to be forgotton, and that can be worked out on the nearest board fence with practically perfect accuracy. Describe two circles from the same center, Fig. 6, one the full travel of the valve, and the other representing the stroke of the engine drawn to scale of 1½′′ to a foot or ⅛ size. Call one the "stroke circle," and the other the "valve circle."

In an engine like that of W. S. these circles would be, stroke circle 1⅝″, valve circle 2⅝″. If a horizontal engine and running in direction of arrow, draw a small circle on line, *X Y*, at *X*, to denote the crank pin on dead center line, then lay off the two points, *E*, *E′*, distant from the vertical line, *D*, *K*, a space equal to the probable amount of lap required to give the desired cut off in the cylinder. Now, plant one leg of the compasses on the stroke circle at *X*, and the other leg on the valve circle at *E*, and fasten. Next







commence moving both legs round, each on its own circle, until the *E* leg reaches *E*, then note where the other leg is on the stroke circle. It will be found at *H*, *the point of cut-off*.

Continue the movement until the *E* leg reaches *K*, then note where the other leg is on stroke circle as before. It is found at *J*, *the point of exhaust*. Measured horizontally these distances are found to be 5¼″ and 1½″ from *Y*, the end of the stroke, and if they should prove to be the distances desired, no more work is necessary.

The above rule is only correct (in all particulars) when there is no inside lap. If there should be say ⅛″ of inside lap, then leg *E* of the compasses would be moved to a point ⅛″ *beyond K*, instead of *on K*, to make intersection *J*, and so of a ¼ or ⅜″ inside lap as the case might be, in each case the intersection *J* being the point of exhaust.

To find the point where the cushion on the exhaust steam commences, place one leg on *D*, and make intersection *N*, the cushion point. If the valve had the ⅛″ of inside lap above spoken of, then in that case the cushion point would be found by placing one leg ⅛″ to the left of *D*, to produce *N*.

No account is taken of the angularity of the connecting rod, &c.

For the benefit of those who must know the why and wherefore of a thing, Fig 5 is submitted with diagram Fig. 6, in miniature (to scale) in relative position to valve and seat.

It will be noticed in diagram *A*, Fig. 5, that line *E*, in Fig. 6, is really thead mission edge *P*, of the steam port, *P*, *O*, and that the leg of the compasses designated as *E* leg, is in reality the admission edge *R* of the valve, and by reference to diagram *B*, Fig. 5, the further movement of the compasses represented the exhaust edge *Q*, of the valve, moving toward the exhaust edge *O*, of the port *P*, *O*.

Every machinist should master the above. There is no better way than to design a few valves at leisure.

JOHN A. CALDWELL.

Bay Ridge, L. I.

Railway Exposition Notes.

BY ANGUS SINCLAIR.

A ramble through the Exposition impresses one forcibly with the magnitude of the commercial interests involved in supplying railroad corporations with the appliances for carrying on their work. In this vast building, and in the large annexes, there is a magnificent display of all the necessaries and luxuries of railroad operation. To grasp mentally the particulars is a most laborious process, for the variety of graduation, from the monster mastodon locomotive to the tiny but intricate locks, that would hardly fill a vest pocket, exhibited by the Yale & Towne Manufacturing Company; from the ponderous steam pile hammer of the Vulcan Iron Works to the snappish conductor's punch, which is quite an important tool in its line—is bewildering. Amidst the galaxy of exhibits there are several collections whose claims to be railway appliances are based on very slight foundation; but the great mass of the exhibits are eminently practical in their application to railroad work.

In nearly all industrial exhibitions that I had previously seen, the majority of the articles displayed were gotten up for the occasion, by lavish expenditure of elaborate skill and finish, that were calculated to prove what could be done by extravagant work on specially selected material, to produce a fancy article fit only for show. Here it is entirely different. Most of the productions exhibited are made for actual service, and within a few months the greater part of them will be doing their work. In a few instances extra polish has been put on, but such articles are exhibited side by side with their plainer companions of the same material.

A great many of the exhibitors brought on their goods under arrangements for shipping them from Chicago to the buyers. Thus, some of the Worthington pumps that are rushing streams into tubs and circulating water, for the instruction of visitors as to how much water a big, well-constructed pump can throw, will in a few weeks be sending water into large tanks for supply of steam and domestic purposes. One of J. A. Fay & Co.'s large wood-working machines will be shaping timbers for Pullman cars. The Hancock inspirators, whose operation Mr. S. A. Randall takes so much pleasure in explaining to visitors, will be scattered all over the States, keeping water over the crown sheets. Horton's lathe chucks, that make such a neat display while pyramided, will be taken apart and turned from shining ornaments to the everyday purpose of holding metal to be turned. Wheels that are pivoted on rollers, to show how nicely they revolve

without a pound of misplaced weight, will be thundering along under express trains. Locomotives that are the admiration of every eye will be toiling along with their living freight behind. And so the round goes.

Most of the exhibits are very tastefully, and in many instances artistically, arranged. The exhibits of the various booths or stalls look like small bazars, every inch of space being utilized for the best kind of display. Some of the brass goods are arranged around obelisks, columns, stepped pyramids, cones, and similar figures, the effect being fine, while the exhibits are shown to the best advantage.

A railroad man who has been around much and has kept his eyes open, will not see so very much in the Exposition that is new in design. But the ordinary run of railroad men will see the very best kinds of appliances for doing all sorts of work in each one's line. The isolated men, who never see methods or tools except what are used on their own road, get their petrified habits shaken up by a ramble around the display. In this respect such an exhibition is an excellent school, and it would well repay railroad companies to send their foremen and leading shopmen here to get the rust of habit rubbed off.

The display of railroad shop tools is remarkably good, and in some instances surprisingly perfect. With the tools exhibited by the Pratt & Whitney Co., of Hartford, Conn., a master mechanic could start up a shop and do the whole rolling-stock work of a road three or four hundred miles long. And scores of master mechanics have had to do a similar range of work with a much inferior assortment of tools.

In showing appliances whose action is difficult for the uninitiated to understand, several of the exhibitors have adopted a plan that must prove interesting and instructive. The injector, for instance, is a simple enough article, and the philosophy of its action is not difficult to understand, but a great many of the men who work injectors, and not a few who are required to repair them, have acquired no more comprehension of the thing than what is absolutely needed for the work they do. They cannot read drawings, and they will not study out the letter type explaining an engraving, so they remain ignorant. Most of the injector exhibitors seem to take in the situation, so they exhibit injectors cut in vertical sections, with all the passages exposed. An intelligent engineer, explaining the working of the injector with this in his hand, can impart information in a few minutes that the ordinary run of users would never have acquired. I have met several engineers who confessed themselves wonderfully enlightened by this method of illustration. The Westinghouse Air Brake people carry this illustrated method of instruction even further. They exhibit the air pump and steam cylinder with all the valves and passages exposed; the engineer's valve is cut open, so that its action is readily apparent. That sphinx of railroad train men, the four-way cock, is not only exposed in vertical section, but the skeleton is placed upon an auxiliary air drum connected with the air cylinder by the usual pipes, and the whole thing worked with every detail of movement in view. I was round there yesterday with an old passenger engineer who had risen to the position of train-master on an important road, and he was wonderfully tickled with the movement of the four-way cock valves, and confessed that he had often tried before to get the working of the thing through his head, but never could comprehend it till he saw that section at work.

Several of the safety-valve devices round the building are illustrated in the same way, and receive in consequence close attention from the men who like to look into the why and wherefore of mechanical appliances. Speaking of safety valves, reminds me that Manning, Maxwell & Moore, of New York, among their handsome assortment of gauges and safety valves, exhibit a nickel-seated pop safety valve, which draws much attention. Among the educational features of the exposition, it seems to me that the Richardson model of the link-and-valve motion deserves especial notice. Mr. Richardson is with the model, and takes great delight in explaining its working to the crowd of engineers and other railroad men, who seem to find a peculiar attraction about the device which shows the action of the valve motion so plainly. At present the valve is set to represent the motion of the celebrated engine 169 of the Central R. R. of New Jersey, and the model will be found amidst illustrious surroundings.

Located to the east of the large Corliss engine which drives the machinery, it has for another neighbor the Buckeye Automatic Engine, which is whirling the armatures for the United States Electric Light Company. On the next space is a high-speed Porter-Allen engine, which supplies the power needed to generate the Edison electric light. Other electric light engines are around, spinning at their high speeds, and in a space not beyond sight. Swift exhibits his automatic lubricator, which also claims attention and admiration.

This Exposition presents an unparalleled opportunity for inventors of railway appliances, who have for years wasted their sweetness on the desert air or on the deaf ears of railroad managers, to appeal to the wider constituency of general travelers and railroad men generally. And they have made the best use of their opportunity. If the article most urgently needed is that which calls forth the greatest amount of labor and ingenuity from inventors, the need of an automatic freight car coupler is pressing beyond all others. It is hard to conceive how such a multitude of devices intended to perform the same operation, could be patented as separate and independent inventions that do not conflict in any way with each other's rights.

The number of patent automatic car couplers exhibited is beyond my means of computation. The space round the gallery is almost monopolized by them, and the visitor's patience is generally exhausted by the clamorous attention of the exhibitors before he gets half round the quadrangle, while the main floor, and the annexes have more car couplers sprinkled all around. There are probably ten or twelve patent automatic car-couplers exhibited, that would satisfactorily perform the work they are intended to do; and the general adoption of any one of them by railroad companies, would do much to end the carnage of brakemen that goes on so incessantly. But the difficulty is, to get railroad companies to agree respecting the merits of any particular coupler. There are so many conflicting interests that arise to prevent agreement in a matter of this kind, that the prospect of settlement seems very remote. And so the Juggernaut old hand coupler must go on crushing its victims.

Among the car-couplers there are scores of worthless combinations that contain no point of mechanical merit. Men believe there is a demand for an automatic car coupler, and they set to and invent a contrivance that will hold two vehicles together, without knowledge or thought of the rough usage such a device must withstand to be successful, and they feel mad and sore and indignant when a railroad man says the thing is impracticable.

After car-couplers the next object of invention seems to be freight-car automatic brakes. The invention of an automatic brake is a much more difficult problem than that of devising a plan to couple cars, so fewer men have attempted brake inventing and still fewer have reached development that could stand exhibition. There are ten or twelve brakes for freight service that claim patronage. In every case the mechanical arrangement of the parts is well got out, and in two or three cases marvelous ingenuity and skill have been displayed. As examples of brakes operated by impress on the draw bar the Tallman and the American brake seem to claim the preference. There has been so much thought and labor expended in the last five years in perfecting continuous brakes for freight service, that it seems to be about time for the Master Car Builders to do something in the way of recommending a brake that will do for freight service what the Westinghouse has done for passenger trains.

The locomotive exhibit is intensely interesting. There are several valuable inventions exhibited relating to locomotives. Several spark arresters, the merits of which will be referred to again; two or three forms of grates of novel design, the working model of a locomotive with a return flue boiler, which is steamed up and excites much notice and amusement with its rapid miniature motion. The Newth ash pan is here with the inventor to dilate on its merits as a saver of grates; there are several forms of feed-water heaters, and an invention that aims to utilize the exhaust as a hot-air blast. Of the locomotives themselves, I can give little more than an enumeration now. Half that I would like to say about them would fill up your space.

THE STEVENS LOCOMOTIVE VALVE MOTION.

One of the essential requisites of a locomotive valve motion is simplicity. The devices used on early locomotives were so complicated or unreliable in their action, besides being indifferent distributors of steam, that the advent of the link motion was hailed with pleasure by every one interested in getting trains over the road on time.

The general adoption of the link motion followed within a few years after the invention came out, and it became a recognized feature of the locomotive almost before its shortcomings were understood. When the mechanical world worked deeper into the subject of valve motion it was found that almost the only merit the link motion possessed was simplicity as a reversing gear. As an expansion gear it was decidedly defective. If it cut off at say one-third of the stroke it would let go at about two-thirds and compression would begin when the piston had traveled about two thirds of the return stroke. Between undue compression and short period of expansion the steam was far from doing the amount of work it ought to have performed.

Attempts to improve on the link motion for locomotives have been legion, but they all entailed complications which were inadmissible.

Alexander L. Holley's description of the Corliss Jigger locomotive would apply forcibly to most attempts at improving the expansion gear of the locomotive.

Last year a good deal of attention in mechanical circles was directed to an invention of an independent cut-off by A. J. Stevens, Mechanical Superintendent of the Southern Pacific Railway, placed upon a locomo ive constructed at the company's shops.

This engine had a riding cut-off valve and three eccentrics were needed on each side which complicated the motion a little, but the performances of the engine were so satisfactory that the increased number of parts was considered excusable.

The "Mastodon" engine exhibited at the Exposition of Railway Appliances was built by Cooke, of Paterson, N.J., for the Southern Pacific Railway, from the designs of Mr. Stevens, and the valve motion has the independent cut off alluded to.

But Mr. Stevens while gratified with the performance of this kind of motion was anxious to produce something that would effect similar results with fewer parts. The outcome of his labors is the invention of a valve motion which does all that is performed by the independent cut off, and is at the same time the essence of simplicity.

SKETCH OF STEVENS VALVE.

A handsomely finished working model of the motion is exhibited among the display of Nathan & Dreyfus at the exposition, and receives a great deal of attention from mechanical railroad men.

The motion is planned something after the Walschaërt style, the movement being taken from one eccentric and a connection with the cross-head. There are two valves, something of the Allen pattern, with an additional supplementary passage through the valve for exhaust. These valves are moved by separate stems. The steam ports are at the ends of the cylinder, and one valve moves over each port. The valve stems are connected with a triangular plate suspended above the guides, which is actuated by connections with the cross-head and eccentrics. This movement is so regulated that the valve opens and closes quickly at the beginning and end of the stroke.

In tracing the movements of the Stevens valve motion in full gear I found that the valve was set with about $\frac{1}{8}''$ lead at the beginning of the stroke. The lead is obtained from the cross-head connection and can be regulated according to the class of service required from the engine.

When the piston moved $\frac{1}{2}''$ of the stroke the valve, by aid of the supplementary passage, opened the port $\frac{1}{4}''$, and by the time the piston moved $2''$ the valve entirely uncovered the steam port. At the $6''$ point of piston travel the valve stopped and remained stationary till the piston reached the $12''$ point. Then it began to return and cut off at $26''$, but did not release the steam till the end of the stroke, which is $30''$ of piston travel. In the meantime the back valve held the port open to the exhaust till the piston was within $2''$ of the end of the stroke, leaving only that distance for compression.

When the motion is notched up to cut off at $9''$ of the piston stroke, the lead is the same as for full gear. Operated in this way at $2''$ of the stroke the valve gives a port opening equal to $\frac{7}{8}''$, then remains stationary till the piston travels to the $5''$ point, when it returns and cuts off at $9''$, and it holds the steam following the piston to the end of the stroke where release takes place just the same as in full gear. In this case compression began when the piston had traveled $24''$ of the stroke.

It will be seen from these particulars that the Stevens motion supplies the means of wonderfully increasing the utility of the steam within the cylinders, as compared with the best performance possible with the link motion.

The company making the largest quantity of pig iron of any concern in this country has reduced its prices to $20 for No. 1 and $19 for No. 2. Similar action must necessarily be taken by other furnace owners. Dullness and depression in the iron trade have reacted upon the machinery trade, and until the former gives new evidence of stability with confidence on the part of purchasers some drawbacks in the machinery business will be experienced.

The prices of pig iron have undoubtedly been dropped to squeeze out some of the smaller and weaker furnace operators who are regarded as constituting a disturbing element in the market. There is no combination of pig iron manufacturers.

The Western manufacturers of rolled iron by signing the puddlers' scale for another year, without change from the one in force last year, have practically insured the retention of their customers and disappointed those Eastern iron manufacturers who expected to get them away. The mills are reported to have a fair supply of orders on hand.

Attention has recently again been drawn to MM. Neugean and Delaite's process of protecting iron surfaces against rust. A very fine powder of metallic zinc is mixed with oil and a siccative, and applied to the iron by means of an ordinary brush. In many cases one coat is sufficient. Two coats are, at any rate, guaranteed to secure a protection against the corrosive action of the atmosphere, as well as of sea water. The zinc coating gives the iron a steel-gray appearance, and it does not interfere with subsequent painting. A good mixture, of which only the necessary quantity should be prepared, consists of 8 parts, by weight, of zinc, 71 of oil, and 2 of a siccative.—*Engineering.*

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NEW YORK, JUNE 23, 1883.

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The Railway Master Mechanics' Association.

Exclusively technical associations, like individuals who devote their lives to a particular line of investigation, have a tendency to become egotistical respecting their own importance. Because they happen to know more about a certain science or art than the rest of mankind, they are inclined to proclaim their superiority from the house-tops. The Railway Master Mechanics' Association has been a conspicuous exception in this respect; although dealing with subjects of world wide interest, and deciding mechanical questions of international importance, its demeanor has been so quiet and retiring that the investigations and discoveries of the association have been little known beyond railway mechanical circles.

In June, 1868, a few master mechanics met at Dayton, Ohio, and resolved to call a general meeting of master mechanics at Cleveland, Ohio, in the following September, for the purpose of forming an association whose objects were, as the subsequent president expressed it, "to increase the knowledge of their profession, for the advancement of science, the promotion of friendship, and the enhancement of railway interests." In response to the call about fifty master mechanics from the leading railroads met together, and went vigorously into business by adopting a constitution and arranging to investigate some of the mechanical problems in which they were all directly interested. The roll of members rapidly ran up to over two hundred. No defined plan of operations was formed. It was well understood that many important questions relating to railroad motive power remained unsettled; and it was desirable that their combined wisdom should be exercised to indicate the best forms of machinery, the most suitable materials, and the most practical methods for general use.

The first requisite towards ascertaining the work before them, was consultation and discussion on the needs of locomotive departments. Isolation is the generator of narrowness. A master mechanic who carries on work for a few years away from the interchange of living contemporary opinions, gets prejudiced in favor of his own methods, of the patterns he prefers, and of the material he considers best adapted for his work. It is very desirable that uniformity should be followed, as far as is practicable, in the construction and maintenance of railroad machinery. At the time the Master Mechanics' Association was instituted, wide diversity of practice prevailed which was yearly getting wider. Their influence arrested this tendency. Their action in favor of standard forms alone, would entitle the Master Mechanics' Association to the highest praise, for, had the growing diversity of machine details been allowed to go on for many years longer, its correction would have become as difficult as the task of reducing international weights and measures to an acceptable standard. Within a very few years the advisory influence of the Master Mechanics' Association became powerful. When ordinary technical societies, after full investigation and discussion, endorse any device or method, the most they can do is to recommend its merits. When the Master Mechanics' Association agree upon the merits of a mechanical appliance its adoption by the principal railroads in North America is practically settled.

Technical societies generally do their work by discussing questions that are brought before them by certain members reading papers on given subjects. The discussion is seldom more than a criticism, the originator of the subject supplying the information. With the Master Mechanics' Association it is entirely different. It has worked into a system of procedure which makes the investigation of subjects thoroughly effectual and brings out all the information the wide experience of the individual members can furnish.

At each meeting, a committee is appointed to arrange the business for the succeeding convention. This committee prepares a list of subjects recommended for discussion, and sub-committees are selected to investigate each particular subject. This sub-committee dissects its subject, and upon the parts arranges a series of questions calculated to bring out full information from the various members. For instance, when the utility of steel tires was still an unsettled problem, a committee appointed to investigate the subject of steel tires prepared a list of questions of the following tenor: 1st. How many steel tires, and of what manufacture, are in use on your road? 2d. Please furnish detailed report of the performance of each set, stating the number of the set, thickness when fitted for use, present thickness, mileage, diameter of wheel, weight of engine, and nature of service. 3d. Have any steel tires broken while in use on your road? Thus the list goes on exhausting the subject pretty thoroughly. Lists of these questions are sent to all the master mechanics, and upon the answers received the report of the committee is based. This report is usually an interesting document, an epitome of all the valuable information relating to the subject, and becomes the theme of open discussion after it has been read in the meeting.

As the first essential of a good locomotive is a boiler that will supply steam economically under the varied conditions of speed and load and yet be portable, durable, and safe, the master mechanics recognized the importance of the subject by grappling it at their first meeting. They investigated the boiler and inquired into every detail respecting its construction, material, varied forms and proportions, its durability under different circumstances and usage; they experimented to find its strong and weak points, and they brought the full experience and intelligence of the association to demonstrate what ought to be the standard locomotive boiler. To their labors were due the credit of deciding that steel was the material best suited for fire-boxes. They decided this question at a time when great diversity of opinion still existed about the best material for fire-boxes, copper and iron having many advocates. The problem of boiler material and construction opens such a wide field for diversity of opinion, that some part of the subject has been under discussion at every convention. So long as inventive genius leads the way in the course of improvement the subject of locomotive boilers will be likely to remain open. Proportions and materials of wheels, tires and axles and other parts of the running gear received laborious investigation extending over several years, and the results of the reports are indelibly stamped upon our American railroad practice. In their investigations of the best form of locomotive for different kinds of service, the influence of the association favored what is everywhere known as the eight-wheeled engine for passenger or light freight service; while the mogul and consolidation types were recommended for heavy freight business.

To follow the labors of the Master Mechanics' Association through the fifteen annual meetings would be to summarize investigations into every prominent question of mechanical science, as it relates to the railroad world. Its committees left no question unnoticed that required research, and they have shed new light on every subject to which they have devoted their attention. To the work done by the association the railroad traveler is indebted in no small degree for his remarkable immunity from accident; the husbandman has reaped benefits from the same source which cheapened transportation, and during the short period of the association's existence operating expenses have been reduced in many cases fifty per cent. The general public and railroad corporations have reaped substantial benefits from the labors of the Master Mechanics' Association, but the individual members have been the greatest gainers. They have been encouraged to cultivate exact and systematic methods in performing their ordinary work, and valuable technical and mechanical training have resulted from the investigations necessary to carry out the programme of the various conventions. Much valuable labor has been accomplished, but the field is far from being exhausted. Every year brings forth new subjects for investigation. Improved methods of practice are developed, so that this enterprising association is not likely to fall short of material or its work drift into a stereotyped form. The convention next week at Chicago promises to be one of the most interesting and valuable meetings in the history of the association.

Decoy Advertising.

We hear in some quarters complaints about dullness of trade. To manufacturers who find orders not coming in, and who yet desire to simulate the appearance of doing considerable business with prominent establishments, for the purpose of inducing other establishments to buy, we might commend the enterprising example set by an engineering weekly published in Chicago, and now completing its fifth (half-yearly) volume.

The weekly in question, which, by the way, has the rather unusual feature of being dated on Friday, appears to be in the habit of carrying non-authorized advertisements in its columns, presumably for the purpose of enticing other advertisers to invest their money where otherwise they would not be likely to do so.

Our attention has at different times been called to this system of manifest deception, by establishments of high repute, who find, to their surprise, their advertisements paraded in the columns of the weekly referred to, without their consent and without their previous knowledge, and who do not desire to figure as decoys in deceiving others. Exactly what plan of redress is open to firms who object to the use of their names in this manner is not clear; but it would seem that genuine advertisers who are induced to invest their money through the parade of unauthorized advertisements should have some measure of redress open to them in the statutes relating to obtaining money by false pretenses.

Looks a Good Deal Like Banishment.

A subscriber writes us from the Quebec Mine on Michipicoten Island, Lake Superior, operated by the Michipicoten Native Copper Company, enclosing $3 for renewal of his subscription to the AMERICAN MACHINIST for another year, and says:

"Your notice for renewal, December 3, 1882, came to hand here May 6, 1883, being the first mail we have received on this island this year, and I write by the first that goes out. Please do not let me miss any numbers, as I cannot afford that away up here in my banishment."

An impression seems to prevail in most parts of the country that the great Brooklyn Bridge is completed, or so near completion that only a few finishing touches are required. Saturday, June 2, the eight Brooklyn trustees of the bridge were reappointed for another year by the Comptroller and Auditor of that city (the Mayor dissenting). As a reason for their reappointment the Auditor said the bridge *would not be completed within a year*, and he thought it impolitic to take the control of the work out of the hands of those who have carried it forward to its present state. It is probable that the last appropriation of money to complete the bridge has been made by the legislature, but as the tolls now amount to from $500 to $2,000 a day, which receipts (available for construction) will be largely swelled when the railroad goes into operation, the bridge is not likely to be completed in a hurry.

The anxiety of some of the manufacturers of patent medicines in the effort to get the advertisements of their wares into the columns of journals which do not admit such advertisements is sometimes commendable as showing perseverance on their part, to say the least.

As a case in point, a Philadelphia firm has urged considerations of philanthropy toward the readers as well as profit to the publishers of the AMERICAN MACHINIST in soliciting the

acceptance of their advertisement so persistently during the past two years that we have finally been obliged to intimate to them that there is only one way by which they can hope to obtain access to our advertising columns. That way is, the proffer of cash enough to induce us to sell them the paper outright, their advertisement not being in our line. We can only hope our would-be patron will now begin the process of giving us a rest.

A correspondent inquires the name of the American mentioned by J. O. in the AMERICAN MACHINIST of May 19th as having a type writer in London that could be sold for ten dollars. Referring the inquiry to J. O., he replies as follows:

"You can say that I believe the inventor of the type writer mentioned never patented his invention in America, or lived to complete his patent in England. He took out provincial protection, but changed his plan completely before he died. It would not be fair to give the thing away to some stranger to make money out of, but if some one reinvents the thing, then it is all right to let him go ahead."

The Glasgow engineers (machinists) have addressed a circular to their employers asking for an advance of wages "to the extent of one halfpenny per hour." As they work 54 hours a week the advance requested is but 54 cents a week.

In a leading editorial the *Engineer and Iron Trades Advertiser* of that city says that "it is to be hoped that calm counsels will prevail on both sides, so that no rupture, however the masters' decision may go, may take place in the relations at present existing between the engineers and their employers."

We commend this incident to the attention of those free traders who have been prating about the good wages paid mechanics in the shipbuilding districts of Scotland.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(216) D. S., Cedar Rapids, Ia., asks: What kind of oil is used for tempering tools? *A.*—Whale oil is used by some; others use lard oil, and others still a mixture of oil and other substances.

(217) G. J., Chattanooga, Tenn., asks: What are peroxide and protoxide of iron? *A.*—They are combinations of oxygen and iron. We do not understand your other question. Repeat it; also give the title of book from which you obtained figures.

(218) C. B, Lexington, Ill., writes: I have difficulty with my foot lathe, not being able to keep it steady when running fast. I have tried various plans to remedy the defect, but without success. Can you assist me? *A.*—You will find in the AMERICAN MACHINIST, of March 26, 1881, an article on this subject, which, we think, will give you the desired information.

(219) W. J. F., Fenton, Mich., asks: Will you inform me of the best method of cleaning and drying screws, after they have been case-hardened, to prevent them from rust? *A.*—The practice is to dry the screws in a sieve over a fire, then put them in oil, take them out and drain them by placing in a sieve, then dry them in sawdust, either by hand or by tumbling them in a tumbler.

(220) Engineer, New York, asks: 1. In a low-pressure, steam-heating apparatus, with returns to boiler on the floor, when the water is blown out there remains a leg of water in the return pipes one foot high, and a full body of water in the horizontal pipes. Is it right or wrong to leave this water in the pipes all summer? *A.*—If any part of the heating apparatus is emptied, we should say empty it all. 2. To what height can water be lifted by an injector? *A.*—It is claimed by some manufacturers that it is possible to lift water with their injectors a height of 26½ feet.

(221) C. W., New York, asks: What proportions of valve ports, etc., shall I use for a 10″x16″ engine, running at 100 revolutions per minute, to cut off at ⅝ stroke? *A.*—This is rather early in the stroke to cut off with an ordinary single valve at constant travel. The steam ports may be ¾″x10″; exhaust port, 1¾″x10″ bridges, ¾″. For an average cut-off at ⅝ stroke, steam lap, ⅞; travel of valves, 3″. The amount of inside lap you can give the valve will depend upon the clearance in the steam cylinder and the steam pressure in the chest. You can give ¼″ inside lap, and if compression is too great cut it out afterwards. Unless the valve is balanced, it will be a hard one to move, if operated under high steam pressure.

(222) Reader, Omaha, Neb., writes: I have a tank 20 feet diameter by 16 feet high. I wish to stay it with ten hoops. Can you give me a rule by which to determine what size hoops to use, and how to space them, so that by using ten hoops each may bear an equal strain? *A.*—We cannot give a rule for this, and think it will not be practicable to exactly accomplish the end named. The strength of the staves would enter into the calculation, and each hoop would differ in dimensions from the others. Trautwine says in his "Engineer's Pocket Book" that a tank 20 feet diameter and 12 feet deep "may have nine hoops of good iron, placed several inches nearer together at the bottom than at the top. Their width, 3″; the thickness of the lower two, ¼″; thence gradually diminishing until the top one is but one-half as thick. The lower two are driven close together."

(223) E. J. C., ——, Pa., asks: 1. How long will it require to anneal a 10″ or 20″ piece of steel? *A.*—We do not quite comprehend what you mean. If, as we assume, you mean a piece of steel of considerable length, 10″ to 20″ in diameter, it would take several days. 2. Would a plan by which such pieces could be perfectly annealed by twice heating in a forge be of any advantage? I can anneal cold-chisels so that they cannot be afterwards tempered to cut iron. *A.*—A quick process for annealing steel without injuring its quality would be of advantage. The fact that the cold-chisel cannot be tempered after annealing would indicate that the steel had been injured in the process. To be of any use it must not injuriously affect the steel—at least not more than present processes. If, then, it can be annealed cheaper and quicker by your process, it is of value.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

James W. See, Consulting Engineer, Hamilton, O.

Steam Economy—124 pp., in boards. By mail, $1. A. Wilkinson, Manayunk, Pa.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Universal grinders for lathe-centers, chucks, angles or cylinders. C.C.Hill, 144 La Salle st., Chicago, Ill.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

H. E. Penney, manufacturer of Steel Spring Cushioned Helve Hammers. Photo and circular on application. Minneapolis, Minn.

New tool chest, price $10. See description in AM. MACHINIST, April 14th, or send for circular. Goodnow & Wightman, 176 Wash'ton st, Boston, Mass.

Castings furnished for 18″ and 21″ swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Speed and drill lathes, 10″x4′, new design. Self-clamping rest, first-class material and work. Parties about to buy will do well to inquire. C. Wing, Greenfield, Mass.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant. $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

The New Pulsometer, price, 600 gallons per hour, $50; 1200 do., $75; 3,600 do., $100; 6,000 do., $150; 10,000 do., $175; 18,000 do., $225; 25,000 do., $275; 45,000 do, $400; 60,000 do., $500; 120,000 do., $1,000. Write for descriptive book, mailed free. Pulsometer Steam Pump Company, 83 John street, New York City.

The National Feed-Water Heater—the best and cheapest in the market; warranted to heat water by exhaust steam up to 206° to 212° Fahrenheit. This heater commends itself to every practical man. For description and prices, apply to the National Pipe-Bending Company, New Haven, Ct.

Twenty Years with the Indicator. By Thos. Pray, Jr., Editor Cotton, Wool and Iron, royal 8vo, 162 pages, 87 illustrations, printed on heavy toned paper. Bound in muslin, beveled edges. Price, $1.50. Sent postpaid to any address, on receipt of price, by the Boston Journal of Commerce Publishing Company, Boston, Mass.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

"Useful Information for Steam Users"—a 100-page illustrated pamphlet, carefully compiled from the best authorities, on the care and management of the steam engine and boiler, with hints for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, New York.

For a strictly first-class automatic engine, from 10 to 60 horse-power apply to the Straight Line Engine Company, Syracuse, N. Y.; medium or high-speed; perfect balance; fewest parts and fewest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron; unexcelled in smooth running.

Now ready for delivery, volume 5 of the AMERICAN MACHINIST, comprising the year 1882, (52 issues) complete with index, in substantial book form Also a few remaining of volumes 3 and 4 comprising the years 1880 and 1881, can be sent anywhere by express. Price of each volume, $4.00; express charges to follow. AMERICAN MACHINIST Publishing Company, 96 Fulton street, New York City.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

A machine shop is in process of construction at Sanger's Mills, N. H.

The Textile Manufacturing Company, of Westfield, Conn., will build a large factory of its own.

Portland, Oregon, is to have this year a million-dollar bridge, and railroad shops costing five millions.

A company in Pittsburgh, Pa., has subscribed $500,000 for the manufacture of the Love sewing machine.

The Cummer Engine Company, of Cleveland, O., will soon begin work on their new boiler and pattern shops.

The Harvard Clock Company will build a factory in New Bedford, Mass., if $75,000 can be obtained there by subscription.

The firm of Elmore, Singer & Company, of Milwaukee, Wis., has been changed to the Northwestern Malleable Iron Company.

The Staunton Car Manufacturing Company has been organized, with $50,000 capital stock, to build car-works in Staunton, Va.

The Fond du Lac (Wis.) Boiler Works have recently been enlarged by the addition of a structure 60x80, and a storeroom 20x30 feet.

The New York, West Shore and Buffalo Railroad have adopted the Curtis Pressure Regulator on their ferryboats for electric lighting.

The Watrous Engine Works Company, of Brantford, Ont., have added a large moulding shop to their branch factory at Winnipeg.

Cant, Gourley & Co., Galt, Ont., are building a new addition to their factory. They manufacture wood-working machinery of every description.

A toothpick manufactory at Sebac, Me., makes a two-horse wagon load of toothpicks every day, and uses 1,000 cords of poplar and birch wood every year.

The new mills of the United States Iron and Tin Plate Company, at Demmler station, in West Pennsylvania, will be in operation some time this month.

The Paris, Lyons and Mediterranean Railway Company are now turning locomotive engines out of their shops at Paris and Lyons at the rate of nineteen per month.

The Hooven, Owens & Rentschler Company, Hamilton, Ohio, have just brought out, and are now putting on the market, fourteen sizes of their "Hamilton-Corliss" engine.

It is said that the Farrell Foundry and Machine Company, Waterbury, Conn., paid a 200 per cent. dividend last year. One of their leading specialties is the manufacture of chilled rolls.

A company has been formed in Toronto, Ont., with a capital of $50,000, for the manufacture of stoves and other castings, to be called the Toronto Stove and Manufacturing Company.

Considerable of the machinery at the Love Sewing-Machine Works, at Rochester, Penn., has been received and set up. The company expect to commence turning out 300 machines weekly by July 1.

William Hutchinson, late master mechanic of the Galena and Madison division of the Chicago and Northwestern Railroad, has been appointed superintendent of the extensive machine shops of the company.

The shops of the Cincinnati, New Orleans and Texas Pacific Railroad will be located either at Chattanooga, Tenn., or Meridian, Miss.

The Buckeye Car Company, a new corporation, has purchased the old Timms Car Works, near Columbus, O., and will soon begin the building of railroad cars, both freight and passenger. Howard Carlton will be general manager.

The Whittenton Manufacturing Company, of Taunton, Mass., has been incorporated with a capital of $600,000 for the manufacture of cotton cloth and cotton yarn. William C. Lovering, president: Charles L. Lovering, treasurer.

The Phœnix Iron Works, Winona, Minn., are adding a number of improvements to their shops. They are building a new machine shop, 30x100 feet, two stories high, of brick, and are changing and enlarging some of their old buildings.

The Troy (N. Y.) *Standard* says: "The iron and steel mills of this city have all they can possibly do at present, and are running on full time. There is no indication of complications here such as disturbed other iron manufacturing centers."

The Marysville (Cal.) Foundry has turned out the first of a series of guns for log-splitting. The gun is to be charged with half a pound of powder, screwed into the end of a log and fired by means of a fuse. Guns of a similar pattern are in use in Australia.

The Pearl Manufacturing Company, 78 Liberty street, New York, are fitting up a new place for the purpose of turning out all kinds of cigarette machinery. They will put in two engines, shafting, pulleys, machinery, etc, and take their steam from the New York Steam Heating and Power Company.

The machine shops of the Galveston, Houston and Henderson Railroad are in course of erection at Taylor, Texas. This fact seems to give an impetus to the development of local industries, as a national bank building, a large hotel and a hardware store building are being erected.

On account of a lack of orders, part of the chain works at West Middlesex, O., have shut down. Of the employes, the single ones were discharged, the married men being retained. Of course the single men will profit by this experience, and take unto themselves wives when they get other jobs.

W. P. Hunt, president of the South Boston Iron Company, has completed contracts at the War Department, Washington, aggregating about $175,000. The contractors agree to construct four 12-inch rifle guns at $300 each, one large mortar, and to convert fifty 10-inch smooth bores to 5-inch cannon, at an average cost of $600 each.

Critchley & Whalley, of Portsmouth, N. H., who manufacture Critchley's expanding reamers, do general machine jobbing, and make iron and brass castings, are forming a stock company, and are going to erect a building 200x70, two stories high, with two ells 100x30, each the same height, with iron and brass foundry and boiler shop connected, all of brick.

James Mitchell, who now occupies for general foundry purposes the building from 22 to 32 Water street, Brooklyn, N. Y., is building a new foundry on lots from 56 to 62 Water street. The new building will have a frontage of 78 feet 4½ inches, and will be 50 feet in depth. For 25 feet the building will be four stories high, the remaining part being one story. After moving to the new foundry, he will utilize a portion of the old building for storage purposes.

The Boston *Commercial Bulletin* says that the new foundry of the Home Sewing Machine Company, Orange, Mass., will be finished in July, and is the largest in the State, having a capacity for 200 moulders and melting 30 tons of iron daily. The building is of brick, 300x60 feet, with a wing 100x60 feet. Superintendent Sisson has recently added machinery for ramming the sand and drawing the moulds, which greatly increases the foundry's capacity.

The Frost-Peterson Veneer Seating Co., Sheboygan, Wis., are building a new factory, 120x80 ft., three stories high. They will put in a 150 horse-power Babcox & Wilcox boiler, and a 14″x30″ automatic cut-off Cummer engine. The shop will be equipped with the latest improved hydraulic presses, made for their special use, and other improved machinery for veneering purposes. This factory is an addition to their factory at the foot of West 30th street, N. Y. City. They own their own wood-land in Sheboygan, Wis.

The Denver *Journal of Commerce* says: "The parties preparing to manufacture matches in Colorado have determined to locate at Buena Vista, on the Arkansas River. This is on account of the splendid water power there to be had, and the close proximity it is to the lumber to be used. The machinery, such as cannot be had at the East, is being made here in Denver. The Diamond match monopoly make it very difficult to obtain the necessary appliances. But the Colorado company will go ahead, regardless of these things.

The prospects are that the blast furnace on the shore at the north end of the city of Fond du Lac, Wis., will be started up this season. The furnace was put in nine years ago by C. J. L. Meyer, and has never been operated. The buildings are of stone and very expensive; in fact, much more so than is at all necessary for the purpose. The facilities of this city for obtaining ore and for shipping the iron cannot be questioned, and, moreover, it lies on the direct route from the iron region to the great mills where the iron is worked up. A large number of men will necessarily be employed when the works start.

Machinists' and Engineers' Supplies.

NEW YORK, June 7, 1883.

The most important event of the week has been a reduction in prices of Pig Iron by the Thomas Iron Company to $20 for No. 1 X Foundry, and $19 for No. 2 X. Hand-to-mouth purchasing is likely to continue for some time yet, in view of the possibility of still further reductions. Tin is a trifle easier. Copper and Spelter unchanged. Antimony dull, with small demand.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Parties in temporary need of experienced and practical draughtsman on reasonable terms. Address, A. W. C., care AM. MACHINIST.

Wanted—Strictly first-class foundry foreman with knowledge of stove work, jobbing and bench. Liberal salary. State age, experience, wages expected; also hardware pattern makers. J. Smart Mfg. Co., Brockville, Canada.

Wanted—Superintendent for factory near New York. Must understand machine shop, wood shop, foundry, blacksmithing, etc., according to modern customs, and be a man of proven ability. Address, stating experiences, expectations, etc., "Wood and Iron," care of William Young, 21 Park Row, New York.

A wide-awake, pushing mechanic desires a position with some reliable firm as superintendent or foreman. Is experienced in management of shop and men, and designing and constructing tools, fixtures and machinery. Would take an interest in business, if satisfactory. Address, Box 7, care AM. MACHINIST.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

Wanted—Catalogues and price-lists of good mechanic and boiler-makers' tools. Critchley & Whalley, Portsmouth, N. H.

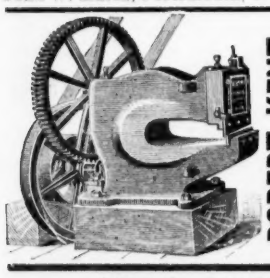
Wanted—Special machinery and tools for manufacturing hangers, shaftings, pulleys and couplings. Send estimates and catalogues, W. H., care AM. MACHINIST office.

Wanted—Special machinery to manufacture; have pattern shop, foundry and machine shops; parties having machinery made by contract will find it to their advantage to correspond with us. Shultis & Co., Kingston, N. Y.

For Sale—One-half interest in a good machine shop, located in a splendid town of 10,000 inhabitants. Machinist or foundryman, with $3,000 ready cash, will find it to his interest to investigate. Address, box 2,045, Ottawa, Ill.

Wanted—A man with a small capital (from $3,000 to $8,000) and a large capital of brains and experience in the foundry and machinery or agricultural tool business as a partner in a well-established and paying business on the Pacific Coast. The best of references required before particulars are given. Address "Pacific," care this office.

A first-class chance for business. A machinist or any one having general knowledge of the foundry and machine business, with several thousand dollars to invest, can get an interest and full control in a No. 1 shop, equipped with new tools and machinery. To one having cash and brains and desiring to build up for himself, no better opportunity can be offered. For further particulars address John W. Marsh, Portsmouth, O.



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Manufacturers of
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Also, Plate Bending Rolls.

GEAR CUTTING
of Every Size and Description, in Steel, Iron or Brass. All Kinds of Gear Wheels Made to Order. Every Machinist or Mechanic should send for Gear Book, gratis. GEO. B. GRANT, Alden St., near Court St., Boston, Mass.

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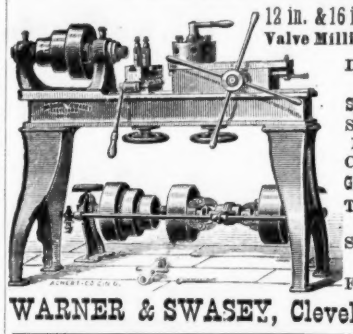
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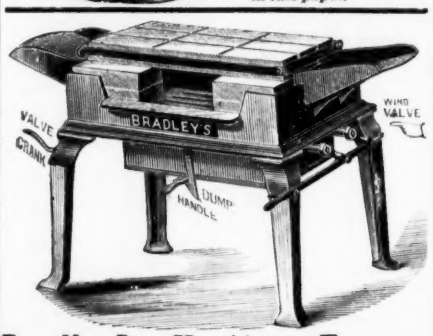

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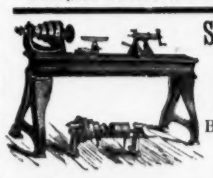
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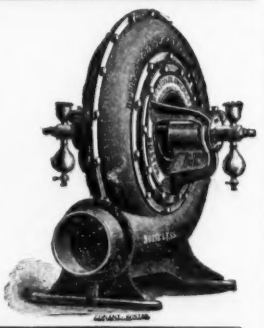

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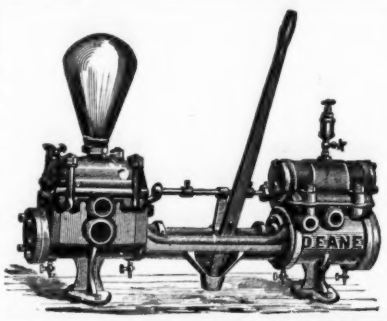

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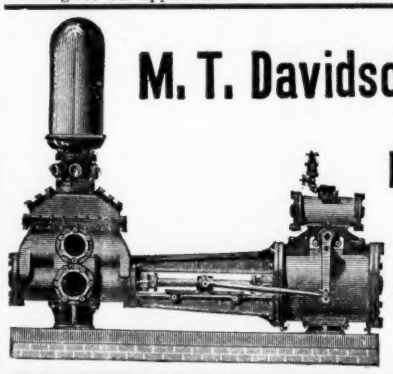
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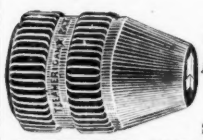
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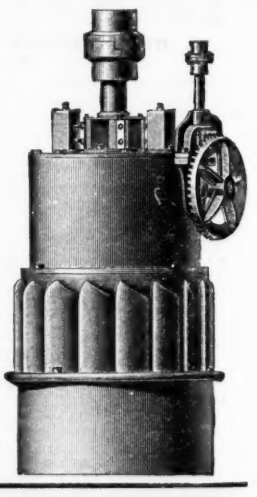

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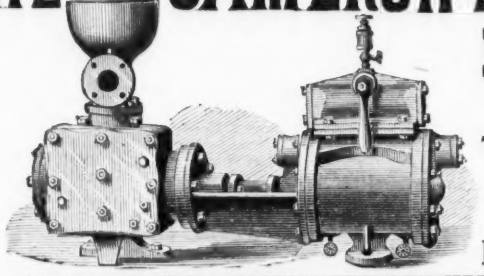
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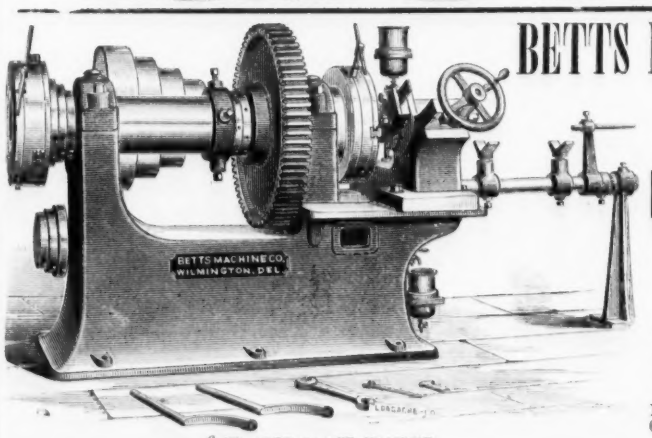

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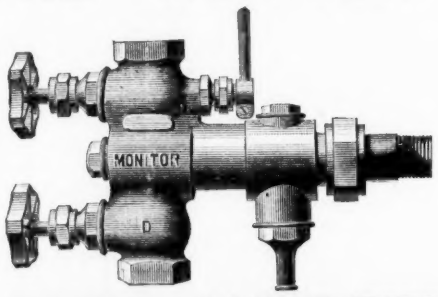

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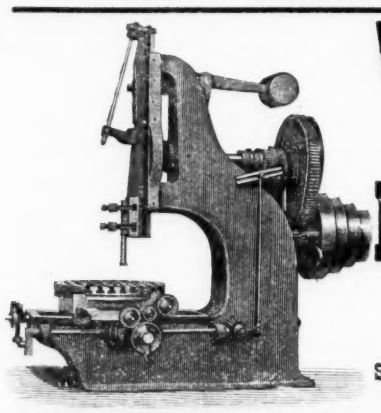

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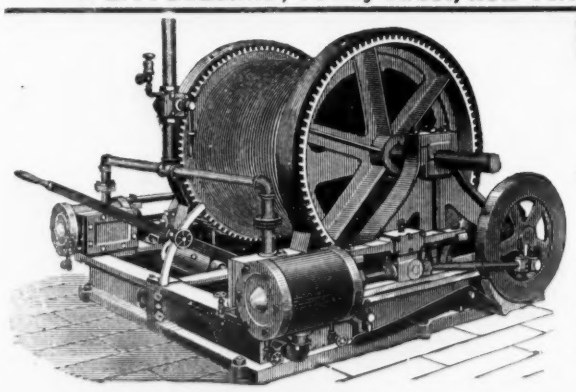

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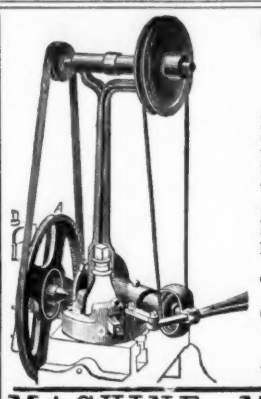

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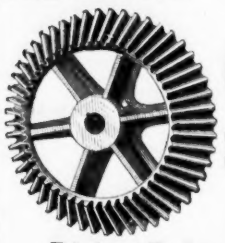

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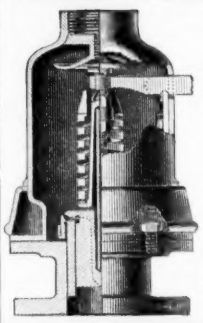

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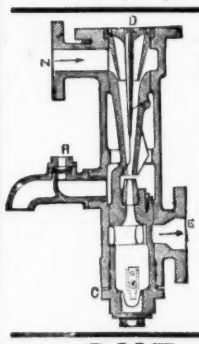

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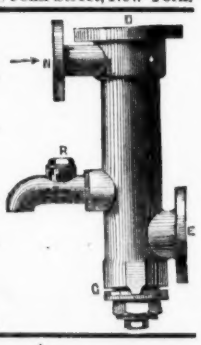

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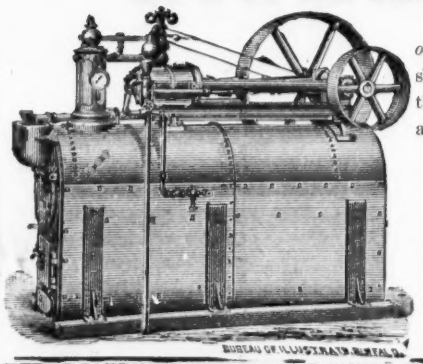

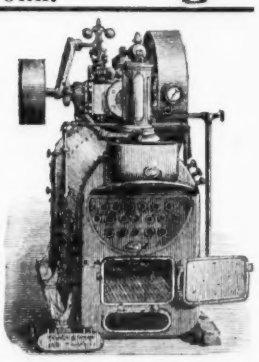

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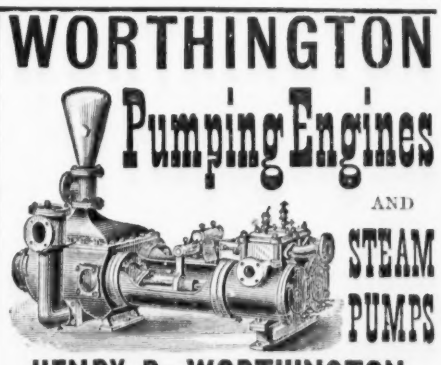

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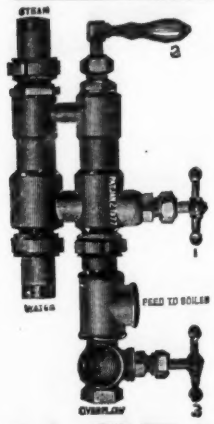

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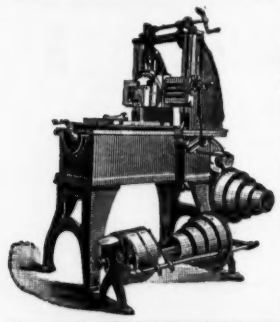

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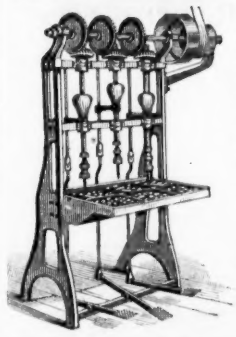

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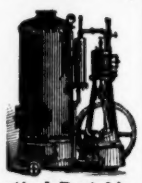

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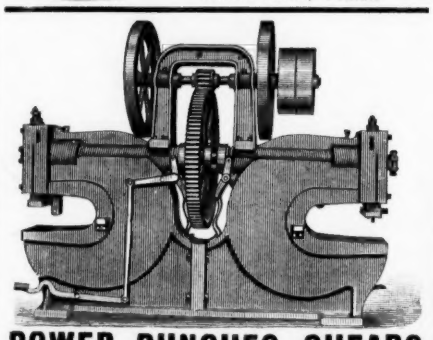

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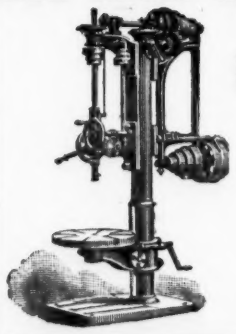

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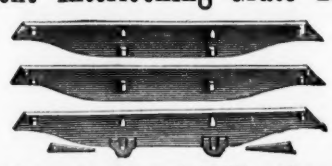

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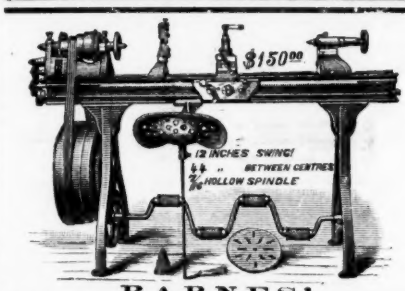

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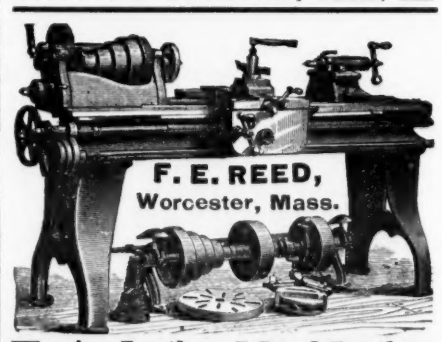

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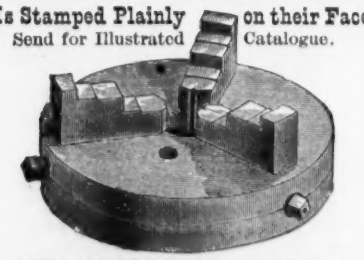

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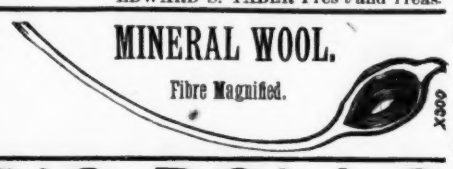

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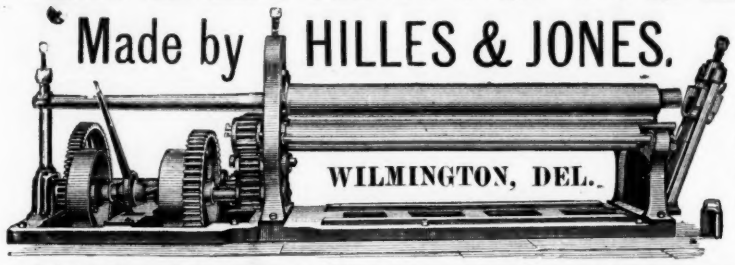

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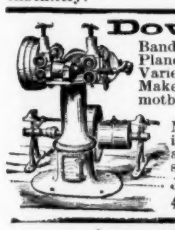

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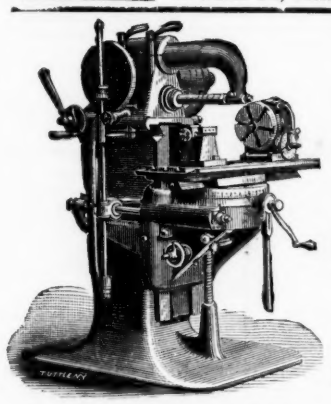

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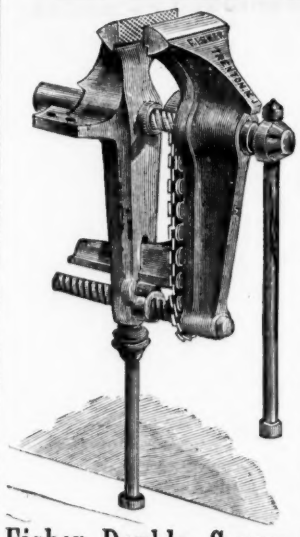

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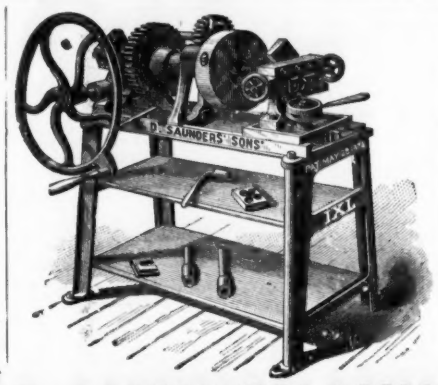

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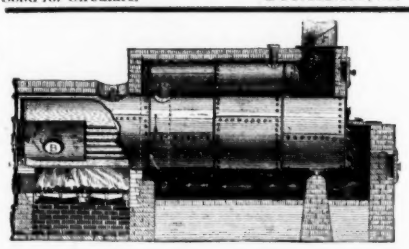

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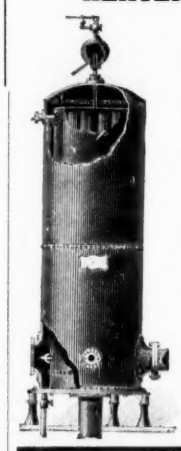

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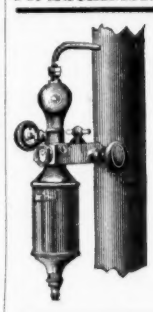

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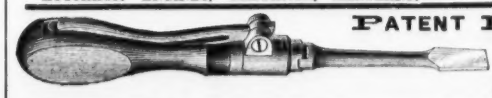

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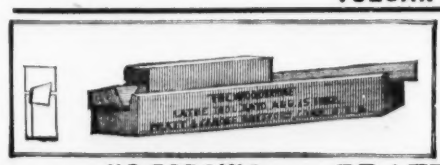

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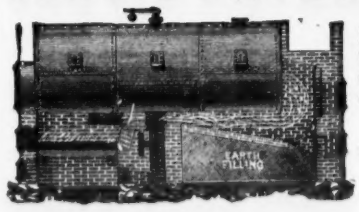

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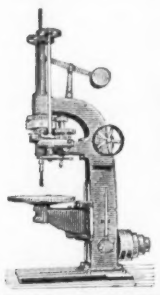

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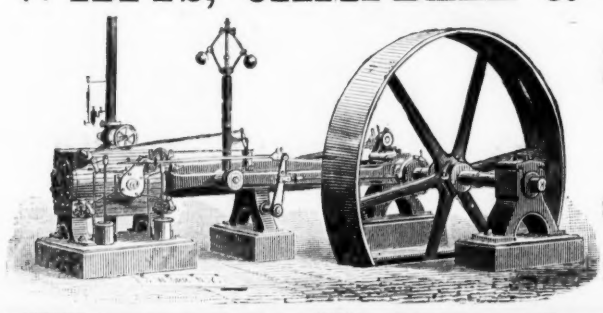

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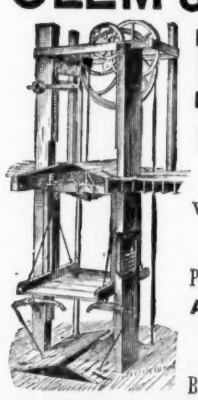

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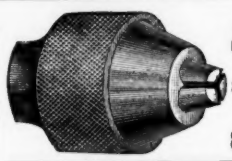

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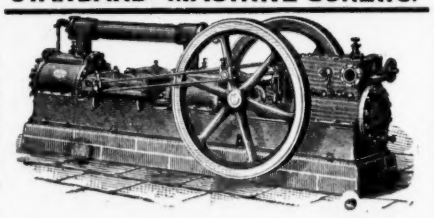

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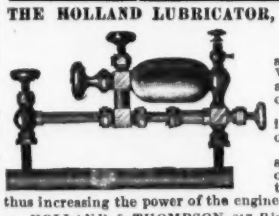

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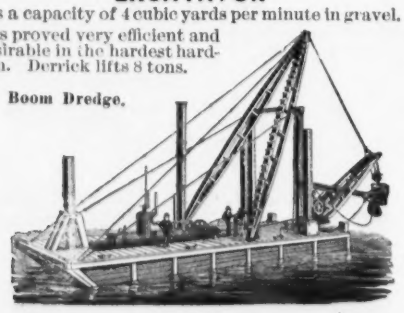

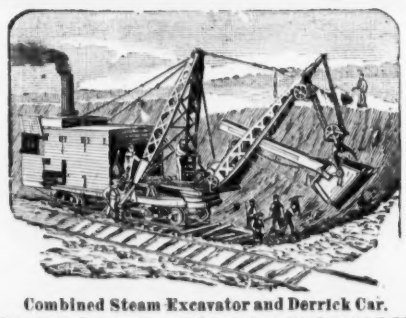

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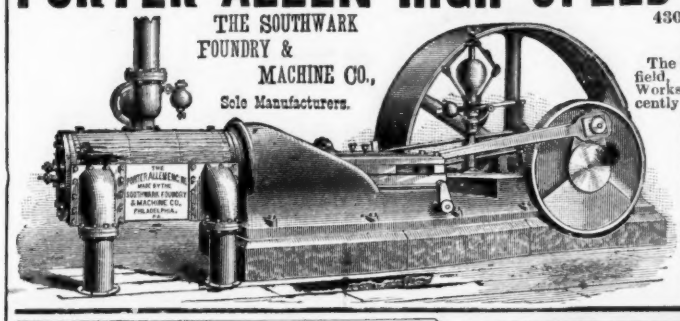

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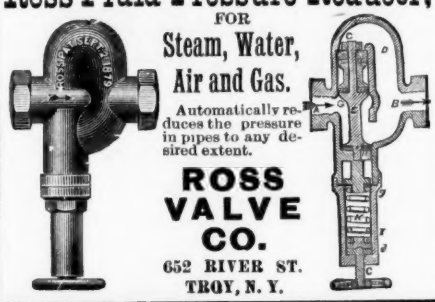

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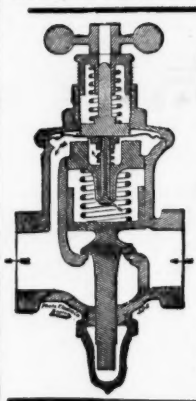

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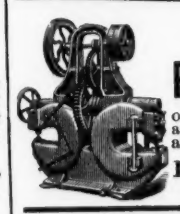

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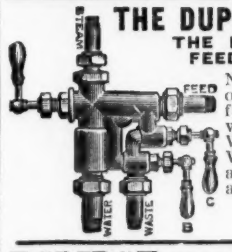

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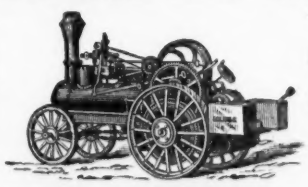

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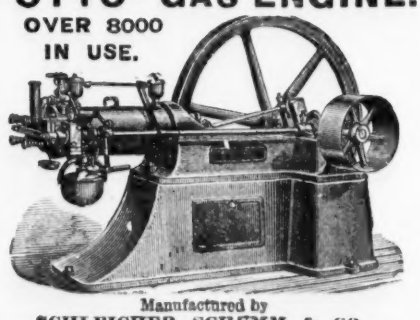

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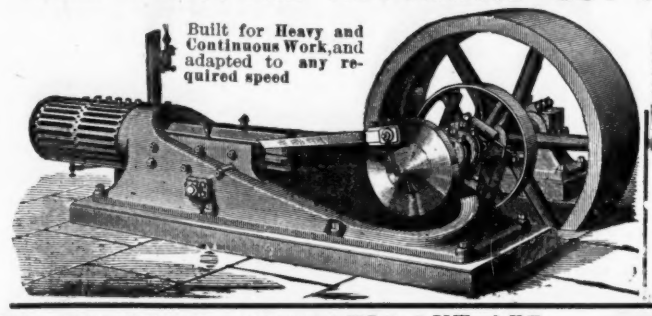

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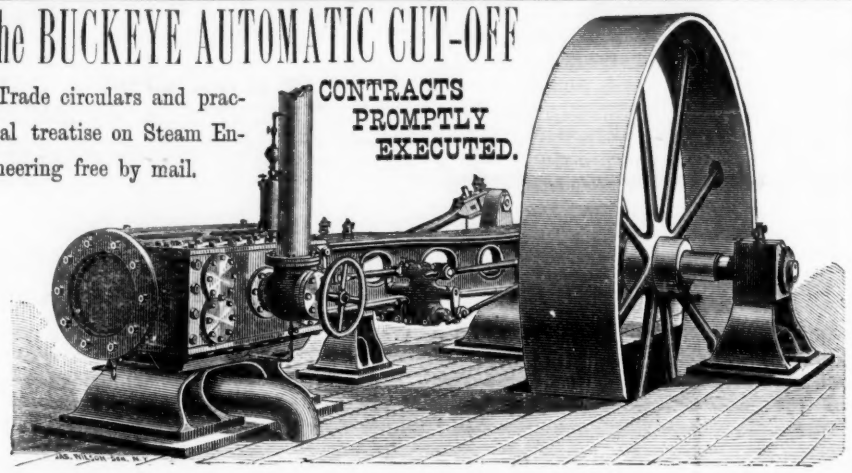

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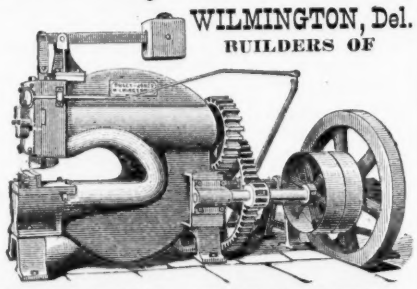

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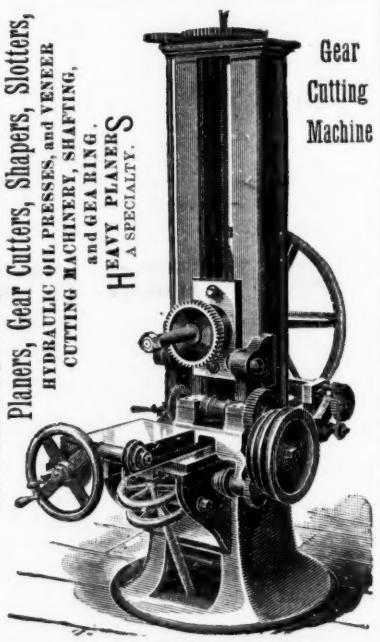

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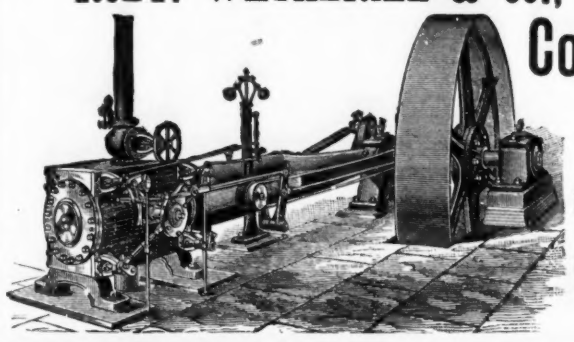

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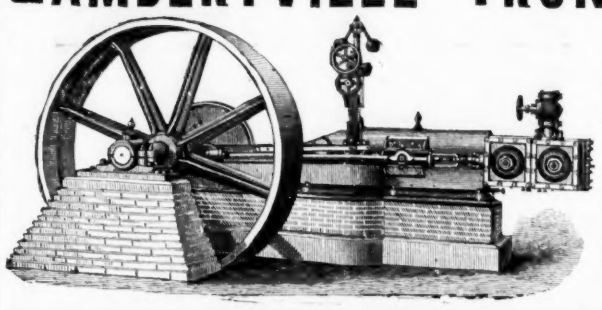

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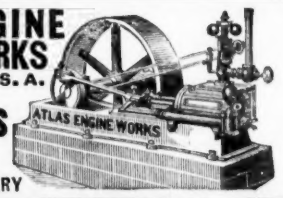

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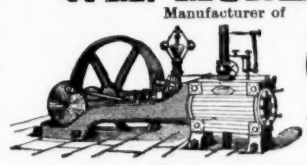

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We have the following second-hand Machinery for sale, viz.:

One Iron Planer, to plane 24 feet long, 62 in. x 62 in. square. It is powerfully geared, heavy and in good order.

One Planer to plane 15 ft. long 51" wide very good.

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One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.

One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.

One 3 ft bed, 9 in. Foot Power Screw Cutting Lathe, with tools.

One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.

One Combined Power Punch and Shears, to punch 5/8 and 1/2, and shear 1/2 in. iron.

Three No. 2 Pratt & Whitney Milling Machines. Very good.

One No. 3 Pratt & Whitney Screw Machine, very good.

One Axle Lathe, Fitchburg Machine Co.

One 13 in. Shaper, Lowell Machine Shop.

One No. 1 Brown & Sharpe Screw Machine.

Two 4 in Spindle Drills.

One 3 Spindle Drill.

One Pond's double Miller.

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121 CHAMBERS AND 103 READE STREETS, NEW YORK.

SMALL SIZE

Universal Milling Machine.

MADE BY

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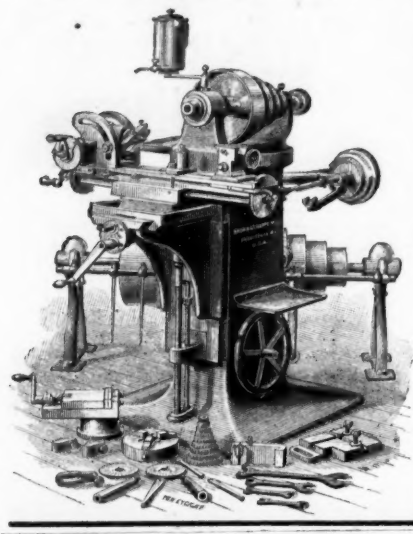
PROVIDENCE, R. I., U. S. A.



This machine has all the movements of a plain Milling Machine, and, in addition, is fed automatically, at an angle to the axis of Spindle, and has an adjustment to stop at any required point. The knee can be moved perpendicularly through a distance of 14 inches, and has a dial giving a reading in thousandths of inches. The Saddle, holding the Spiral Bed also, has a movement, parallel with axis of Main Spindle, of 6 inches, also indicated in thousandths of inches. On the Spiral Bed are placed a Head and Foot Stock, having centers upon which Reamers, Taps, Drills, or Mills can be held for grooving, etc., either straight or spiral, right or left hand. The Head, holding one center can be set at any angle between 5 degrees below a horizontal to a perpendicular position, and upon an Arbor inserted in the Spindle can be cut angular Mills, Cutters, or Bevel-gears. The Head can also be placed at a right angle on the Bed, and operations performed upon the face of work held in a chuck which goes upon the end of Spindle. The Vise shown in cut has Jaws 5 inches wide, 1 inch deep, will open 2¾ inches, and can be clamped upon the Bed at any angle.

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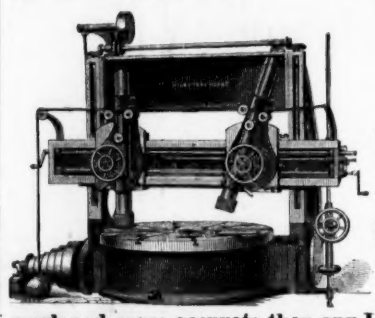

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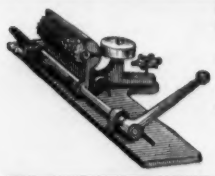

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